CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS



GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 322

# GROUND-WATER RESOURCES OF SURREY MUNICIPALITY BRITISH COLUMBIA

By

J. E. Armstrong and W. L. Brown



OTTAWA

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# GROUND-WATER RESOURCES OF SURREY MUNICIPALITY, BRITISH COLUMBIA

## CHAPTER I

## INTRODUCTION

### GENERAL STATEMENT

This report deals with ground-water conditions of Surrey Municipality in the province of British Columbia investigated by the Geological Survey of Canada during the field season of 1950 and 1951. Geological mapping of the area was carried out under the direction of J. E. Armstrong and W. L. Brown. The water investigation was supervised by W. L. Brown and much of the water data was collected by him, and by O. Hughes and G. Hughes. Others whose assistance in the field work is hereby acknowledged were: in 1950 - W. M. Draycot, J. G. Fyles, P. 'Odynsky, H. Naismith, J. Allan, and B. Young; in 1951 - Miss F. J. E. Wagner, W. M. Draycot, Rev. R. Sanschagrin, O.M.I., L. F. Brandon, and W. Atamanchuk. The writers would also like to thank all well owners and drillers for their co-operation and willingness to supply information.

Ground-water surveys in this area provide basic information necessary for the future development of domestic, irrigational, industrial, and municipal ground-water supplies. This survey has shown that large ground-water supplies are available in gravel and sand aquifers within 375 feet of the land surface. Although gravel and sand deposits at greater depth undoubtedly contain other ground-water reservoirs the information on them is so meagre that they are not dealt with in this report.

### METHODS OF INVESTIGATION

The investigation included the collection of data on 1,342 wells in the area. These records vary greatly in accuracy, as in most cases no drilling data

were recorded and the information obtained is based mainly on the memories of well owners and well drillers. The most accurate information was gained from wells being drilled at the time of the survey, as such wells were observed during the course of the work and pertinent data obtained. Later studies in the office showed that on the basis of known geology the information obtained on about 350 wells could be interpreted with accuracy, and only these records are included in this report and plotted on the accompanying map. Information regarding other wells may be obtained from the Geological Survey Office, Vancouver, B.C.

## LOCATION AND EXTENT OF AREA

Surrey Municipality covers the south-central part of New Westminster map-area and extends from the Canada-United States boundary (700 feet north of the 49th Parallel) a maximum of 15 miles, to latitude 49°13' N. The eastern boundary follows a meridian a few seconds east of 122°41' W. and the western boundary of the municipality is about 122°53' W. The area of the municipality is approximately 130 square miles.

## CLIMATE

The climatic conditions of the Lower Fraser Valley are highly variable and depend upon several factors, the most important of which is the mountain relief north and east of the region (Kelley and Spilsbury, 1939, pp. 9-13)[1]. The annual precipitation varies from 35 inches on the recent delta to 80 inches at the foot of the Pacific Ranges. The characteristic feature of the region is a heavy winter rainfall and a summer dry period. About two-thirds of the annual precipitation occurs during the 6 months from October to March (See Figure at back). The growing season, from April to September, even in wet years has too little precipitation for the maximum development and yield of crops.

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[1] See References, page 8.

Abnormally dry summers, amounting to drought conditions, were experienced in 1951 and 1952. These droughts markedly affected crop production in Surrey Municipality and led to an increased interest in irrigation, and particularly in the use of ground water for this purpose. Although the precipitation for 1951 and 1952 was unusually low the precipitation pattern remained about normal. The annual precipitation pattern, as may be seen from the graph, indicates the paucity of rainfall during the growing season, and, therefore, the necessity of irrigation for maximum crop yields.

The rainfall patterns indicate that annual replenishing of the ground-water reservoirs is readily obtained. The heavy sustained rains from October to March allow a long period for infiltration and keep the soil and sediments above the water-table continually wet. The heavy rains also come in the season when vegetation requires little water, and at a time of the year when humidity is high and evaporation very low. These considerations show that apart from run-off, which is appreciable in some sloping areas, a large proportion of this winter rainfall infiltrates into the soil and becomes a part of the body of ground water beneath the municipality.

## AGRICULTURE[1]

The type of agriculture throughout the Lower Fraser Valley is dependent upon local drainage, climate, availability of ground water or surface water for irrigation, soil type, and natural vegetation. The requirements for the Vancouver market, which is the main buyer of the valley's produce, also determines to some extent what is grown.

The Recent delta and lowland areas contain the best farms of the region. These areas, because they lacked heavy timber and bush, were the first to be developed once dyking was completed. Where the peat is less than 6 feet thick

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[1] Kelley, C. C., and Spilsbury, R. H.: Soil Survey of the Lower Fraser Valley; Dept. of Agriculture, Canada, Pub. 650, pp. 14, 15 (1939).

the ground in many places has been cultivated with success, and experiments are continuing, so that the unusable parts of these lowlands, once extensive, are diminishing yearly.

Dairying, mixed farming, and market gardening are the main types of agriculture presently being conducted in the lowland areas.

The uplands with poorer soil and less accessible water do not lend themselves to large scale farming but are made up mainly of small holdings. The higher parts of some of the uplands, with their dry gravel surface mantle, are ideally suited to chicken and turkey raising. This is possibly the most lucrative business of those carried out in the upland areas. Small fruits and vegetables are the principal crops grown on the uplands.

The northern parts of Newton Upland have been extensively subdivided by commuters into a suburban area. Homes surrounded by 5 acres or less are common. This suburban development is presently confined largely to that part of the Newton Upland close to Fraser River. Although little harm is expected from the present suburban development of the uplands, wholesale encroachment of the rich delta farms would materially affect the people living in the Vancouver metropolitan area.

## POPULATION

According to the unpublished results of the 1951 census the population of Surrey Municipality is 33,670[1].

## TOPOGRAPHY AND DRAINAGE

Surrey Municipality forms a part of the lower Fraser Valley area of southwestern British Columbia, which in turn forms part of the Georgia Depression. The municipality is bounded on the north by Fraser River, which

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[1] Bureau of Statistics, Dept. Trade and Commerce, personal letter.

occupies an apparently post-Glacial valley up to 3 miles wide and 50 feet or more deep, which in turn lies in the lower Fraser Valley lowland area. Fraser River has a length of 790 miles from its source in Yellowhead Pass, and drains an area of 91,700 square miles. It terminates in a delta 19 miles long and 15 miles wide that is still growing.

North and south of the valley of Fraser River and comprising most of the lower Fraser Valley area, including all of Surrey Municipality, are wide, relatively flat-topped uplands separated by wide, flat-bottomed valleys.

## Lowlands

All except that part of Surrey Municipality near Fraser River is drained by the Nicomekl and Serpentine Rivers and their tributaries, and Campbell Creek. All three streams obtain much of their water during the dry summer period from ground-water aquifers. Along most of their courses Nicomekl and Serpentine Rivers, and Campbell Creek along the lower half of its course, meander across the floor of flat to very gently undulating valleys from 1 1/2 to 3 1/2 miles wide. These valleys are former embayments of the sea. The main valleys of the Nicomekl and Serpentine vary in elevation from about 5 to 30 feet above sea-level. The valley of lower Campbell Creek is from about 25 to 75 feet above sea-level. Mahood Creek, the principal tributary of Serpentine River, Anderson Creek, a large tributary of Nicomekl River, and the upper part of Campbell Creek all occupy relatively narrow valleys entrenched in the uplands.

Nicomekl and Serpentine Rivers are contained by dykes throughout much of Surrey Municipality as a protection from floods resulting from heavy rainfall, which may occur at any time of the year except the dry summer. Flooding results where a ground-water body is perched so near the surface in the lowlands that the excess rainfall cannot be absorbed, and from rapid run-off in uplands cleared of forest growth for settlement. Nicomekl and Serpentine

Rivers occupy one large valley for the last 5 miles of their courses. This valley is dyked on the seaward side as a protection against tidal flooding. During the winter of 1951-52 these dykes broke when very high tides combined with strong gales.

In Surrey Municipality only small spring-fed creeks drain into Fraser River.

## Uplands

The upland surfaces are of two main types: (1) rolling hilly surfaces of glacial till and stony clay, including the Newton, Clayton, and Sunnyside Uplands; and (2) commonly flat, terraced surfaces of glacial outwash, including the Campbell Upland.

Newton Upland. This upland, which is bounded by Fraser River on the north, the Serpentine Valley on the east and south, and the Fraser River Delta on the west, is a rolling hilly surface 200 to 300 feet above sea-level. It is roughly circular in outline,with a diameter of 7 to 8 miles and an area of about 55 square miles. It is bounded in most places by fairly steep slopes, which show, in many places, river or wave-cut terraces. The upland consists of three northwesterly trending, ellipsoidal, high areas separated by two tributary valleys of Serpentine River. The most southerly area has four prominent till knobs that rise to elevations of over 350, 325, 300, and 250 feet above sea-level. The slopes and intervening saddles contain numerous terraces. The middle area is topped by well-formed terraces at 305 and 325 feet above sea-level. Three till knobs rise above the highest terrace to over 350 feet in elevation. The most northerly area contains a large terrace about 200 feet in elevation. The valleys tributary to Serpentine River modify the upland topography with a dendritic drainage pattern. These creeks have numerous spring-fed sources. Each spring is surrounded by a small relatively steep-sided area similar in shape to a box canyon.

Clayton Upland. This upland trends roughly northeast and is bounded on the northwest by Serpentine Valley, on the north by the lowlands bordering Fraser River, and on the southeast and south by Nicomekl Valley. It is a rolling hilly surface 200 to 300 feet above sea-level that is nearly ellipsoidal in outline and about 20 miles square in area. The western extension of the upland surrounding the settlement of Surrey Centre is lower, 125 feet in elevation, and is separated from the main body of upland by a broad saddle 55 feet in elevation. The main upland has one prominent terrace at 250 feet above sea-level. Most of the slopes of Clayton Upland are fairly abrupt and have resulted from wave-cutting, modified by submarine slides and later slope wash.

Sunnyside Upland. This upland, which lies between Nicomekl-Serpentine Valley on the north and Semiamu Bay-Campbell River Valley on the south, is a broad, gently undulating to flat-topped ridge almost ellipsoidal in outline. Three dome-shaped areas occur along the crest of the upland and attain elevations of 325, 350, and 375 feet. The slopes of these areas and the whole upland exhibit marked terraces, there being three prominent terrace levels at elevations of 130, 260, and 310 feet. Less well developed terraces lie between and below these elevations. Many of these can, however, only be observed in small local areas. Large kettle-like depressions occur along the crest of the upland. These are normally not over 3 to 5 acres in extent.

Campbell Upland. This upland is partly in southeastern Surrey Municipality and partly in Langley Municipality. It consists of outwash gravel and sand and has a flat-topped terraced surface 125 to 150 feet above sea-level. It is about 11 square miles in area. The upland, which is an outwash delta, drops off abruptly on the north, west, and south into Nicomekl River and lower

Campbell Creek Valleys. These slopes represent the original depositional slopes. On the east the upland is bordered by a higher upland, the two being separated by a wave-cut slope.

## SELECTED REFERECES

Bennison, E. W.: Ground-water, Its Development, Uses and Conservation; Edward E. Johnson, Inc. St. Paul, 4, Minnesota, 1947.

Johnston, W. A.: Geology of Fraser River Delta Map-area; Geol. Surv., Canada, Mem. 135 pp. 1-86 (1923).

Kelley, C. C., and Spilsbury, R. H.: Soil Survey of the Lower Fraser Valley; Dept. Agriculture, Canada, Pub. 650 (1939).

Meinzer, O. E.: Outline of Groundwater Hydrology, with definitions; U.S. Geol. Surv., Water Supply Paper 494, pp. 1-71 (1923a).

———Hydrology; Dover Publication, Inc., New York, pp. 385-443 (1949).

Scofield, C. S.: Quality of Irrigation Waters: Cal. Div. Water Resources, Bull. No. 40, pp. 1-95 (1933).

Tolman, C. F.: Ground-Water; McGraw-Hill Book Company, Inc. New York, 1937.

Wenzel, L. K.: Methods for Determining Permeability of Water-bearing Materials, with special reference to Discharging well Method; U.S. Geol. Surv., Water Supply Paper 887, 1942.

# CHAPTER II

## PLEISTOCENE AND RECENT GEOLOGY

### GENERAL STATEMENT

The entire municipality of Surrey is underlain by thick deposits of unconsolidated sediments of Pleistocene and Recent ages. The term Pleistocene refers to the period in the earth's geological history immediately preceding the Recent, when great accumulations of ice formed at several centres in Canada. What has been called a Cordilleran Ice-sheet at this time covered all of British Columbia. As the ice advanced, it picked up, transported, and redeposited great quantities of loose rock debris. This material, which is unconsolidated, is called glacial drift, and includes till and stony clay; deposits of stratified drift consisting of gravel, sand, silt, and clay; and scattered boulders. As indicated in the following table of formations of the Surrey area, the ice-sheet advanced and retreated several times and each time left an accumulation of drift. Normal river, stream, and marine sediments were deposited in the intervals separating the advances of the ice-sheet. The term Recent refers, in Fraser River Valley, to that period in the earth's geologic history since the disappearance of the Cordilleran Ice-sheet.

The unconsolidated sediments in Surrey Municipality attain a maximum thickness of at least 1,350 feet; however, as all the aquifers that can at present be usefully developed occur within 375 feet of the surface, only the deposits in this upper part of the section will be discussed.

### TABLE OF FORMATIONS

The Pleistocene and Recent geology is summarized in the table of formations inserted in the back of the report. In this table the oldest deposits are shown at the bottom and the youngest at the top. Hence, a hole drilled

would penetrate the deposits in the order shown from the top of the table to the bottom except where a deposit has been removed by erosion or locally was not deposited. The deposits included in any one group lie directly above those in the group shown immediately below it, but the deposits included in any one group may be in part contemporaneous.

## GENERAL DESCRIPTION AND HISTORY

Surrey Municipality was covered by three major advances of the Cordilleran Ice-sheet. Each advance produced a glacial till, which is a compact sandy clay containing stones commonly called hardpan. The three tills, from the oldest to the youngest, have been named Seymour, Semiamu, and Surrey.

Stony clay, till-like in appearance and of mixed glacial and marine origin, is associated with the Seymour and Surrey tills, but only that in the latter occurs in Surrey Municipality. Silt, sand, and gravel deposited by streams resulting from the melting of an ice-sheet are called outwash deposits and are normally deposited during the advance and retreat of an ice-sheet. The Abbotsford outwash may represent a late minor advance of the Surrey ice-sheet as it is separated everywhere from Surrey till by Newton stony clay. Gravel and sand included in Semiamu sediments is the only known outwash associated with the Semiamu ice-sheet, and these sediments also include clay, silt, and sand of probable glacial lake origin.

During and following the advance of the Seymour and Surrey ice-sheets, which were upwards of 7,500 feet thick, all of Surrey Municipality was depressed below sea-level. (Information is insufficient to determine whether the Semiamu ice-sheet also brought about depression of the Surrey land surface below sea-level.) When the land was depressed and as it rose again after retreat of the ice-sheets, sediments were laid down in the sea

as bottom, littoral, estuarine, and deltaic deposits, and along the streams and rivers as flood-plain and channel deposits. During and following the retreat of the Seymour ice-sheet, Point Grey beds, Nicomekl silt, and probably Sapperton sediments and Colebrook gravel were deposited, and during and following the retreat of the Surrey ice-sheet Newton stony clay, Abbotsford gravel, Cloverdale sediments, Sunnyside sand, Bose gravel, and Alouette gravel were deposited.

When the uplands of Surrey eventually rose above the sea they were subjected to erosion, the sediments so produced being deposited in the low-lands. These erosion intervals are noted in the table of formations.

The Salish deposits, which are still in the process of formation, consist of silt, clay, and sand deposited by Fraser River and smaller streams, and the peat bogs.

A study of the accompanying geological map will show that the Capilano deposits, except for the Bose gravel and Sunnyside sand, and the Salish deposits, are confined to the lowlands. The uplands in most places are mantled by Newton stony clay and Surrey till. In many places veneers of Bose gravel and Sunnyside sand are found above these.

# CHAPTER III

## GROUND-WATER GEOLOGY

### GENERAL CONSIDERATIONS

Ground water, or underground water, is the water that supplies springs and wells. The finding of potable ground-water supplies has long been of profound importance to man. In arid and semi-arid regions the presence and development of ground water has been a major factor in the growth or absence of civilizations. Only within the relatively recent past have the people living in humid regions come to realize what an important natural resource exists beneath the earth's surface in the form of ground water, especially in those areas of great concentration of population where surface streams are insufficient and contaminated. In other areas, such as lower Fraser Valley, where the annual rainfall, although copious, is scanty in the growing season, ground water has become an important source of water for irrigation and domestic purposes. Even where large surface supplies are available it is commonly more economical, when good engineering practices are used, to allow the natural conduits in the rocks and sediments beneath the earth's surface to carry water to the user, than to construct large, long pipelines or aqueducts.

#### Source

Most ground water is derived from precipitation in the form of rain or snow. Part of the water that falls in this manner is carried away by surface run-off, part of it percolates downward into the underlying unconsolidated sediments until it reaches the water-table where it joins the body of ground water in the zone of saturation, and part of it evaporates or is absorbed and transpired by vegetation and is thus returned directly to the atmosphere.

A layer of water 1 inch deep over an area of 1 square mile amounts to approximately 14,520,000 imperial gallons. As the average annual precipitation in the form of rain and snow that falls on Surrey Municipality is 40 inches, it will be seen that each year some 580,800,000 imperial gallons of water falls on each square mile. The accurate determination of the amount of rainfall entering the ground-water body each year beneath Surrey Municipality was considered beyond the practical scope of this survey, but, because the answer to this problem is of paramount importance, the writers have made the following rough estimate of the amount. The figure is believed to be about 4,500,000,000 imperial gallons a year or about one-seventeenth of the total amount of water that falls as rain or snow upon the municipality.

## Occurrence

Ground water occurs in the open spaces and pores of both consolidated rocks and overburden near the surface of the earth. These openings range in size from huge caverns in limestones to minute, microscopic, and even submicroscopic pores in fine-grained material. They form the receptacles and conduits for ground water, and their size, shape, and relation to one another largely control both the quantity of ground water that occurs in any area and the rate of its movement through the ground to any pumping well or spring. Fine-grained rocks such as clays and shales are, therefore, poor sources of ground water and coarser grained materials such as sand and gravel are more satisfactory. By far the most productive water-bearing beds in Surrey Municipality are deposits of sand and gravel interbedded with or lying below more impervious clay or till.

## Water-table and Movement of Ground Water

The water-table is defined as the upper surface of the zone saturated by free ground water. The pores or spaces of the rock or sediment above the water-table are only partly filled with water, most of which is slowly travelling downwards to the water-table. Below the water-table all the open spaces of the rock or sediment are filled with water, in what is called the zone of saturation. Free ground water is the water in this zone down to the first impervious barrier. Confined ground water is the water separated from the free ground water by an impervious barrier. In places confined ground water exerts a pressure against this barrier, and water will rise in a well that pierces the barrier. If the water rises in the well and overflows at ground surface, the well is called a flowing artesian, but if the water rises only part way to the surface the well is known as a non-flowing artesian. The surface to which artesian water will rise is known as a pressure or piezometric surface.

The water-table is a constantly changing surface that fluctuates up and down in response to the amounts of water that are either added to or subtracted from the ground-water reservoirs. The water-table beneath Surrey Municipality is raised by rainfall and by subsurface drainage from adjoining areas to the east. Any lowering of the water-table is the result of water removed by wells and springs, and the movement of ground water passing beneath the surface into adjacent areas. Direct evaporation from the ground and transpiration through plants is less important in the decline of the water-table.

In areas where the depletion of the ground water by the above factors is only a fraction of that contained in the ground-water reservoir the water-table fluctuation will be negligible. Also if a water-bearing bed or aquifer is

full, then no more water can be added and the water-table will not rise in response to heavy rainfall. The writer believes many of the ground-water reservoirs of Surrey Municipality are full and are being depleted by wells and springs at so small a rate that fluctuations of the water-table are, for practical purposes, absent. Such reservoirs would stand considerable pumping before the water-table is lowered and rainfall can replenish it. Other water-tables, especially those near the surface of the uplands, show marked fluctuations because the water-table is constantly moving downwards during the summer months and the permeability of the aquifers is low. Dug wells that do not extend below the lowest level reached by the water-table in these sediments go dry in summer.

## Recharge

The addition of water to the underground reservoir is called recharge. The water beneath Surrey Municipality is derived from water that falls chiefly as rain or snow either within the municipality or on the adjoining areas of the lower Fraser Valley.

As already stated the average annual precipitation of Surrey Municipality is 40 inches but probably only about one-seventeenth of this enters the ground-water body. The amount of water that recharges the ground-water body depends upon several factors, the most important of which are the type of sediments or soil at ground surface, the depth to the water-table, and the topography of the surface. For example, the large gravel terrace deposited as a delta by a former, and larger, Campbell Creek, near the southeastern boundary of the municipality, is an area of high recharge because the sediment composing this terrace is coarse sand and gravel, the water-table is within 20 feet of the surface, and the surface is flat.

Subsurface inflow is the movement of ground water beneath the surface down the slope of the water-table from adjacent areas to the area being studied. Considerable inflow takes place in the region of upper Campbell Creek from parts of the terrace in Langley Municipality, and extends down the wide valley of this creek. Inflow is also effective in the upland east of Cloverdale from Langley Municipality. The springs described below also help to recharge the water reservoirs under the lowlands. Some recharge is effected from flowing artesian wells permitted to flow freely.

### Discharge

Natural discharge from the ground-water reservoirs takes place from springs and subsurface outflow, with a minor amount subtracted by evaporation and transpiration. In Surrey Municipality most of the discharge takes place as springs at the headwaters of Campbell Creek, Serpentine and Nicomekl Rivers, and their tributaries. Most of these springs are at the base of the uplands. Some submarine discharge may also take place.

The exact amount of ground water used at the present time in Surrey Municipality is not known but is estimated to be about 615,000,000 gallons a year, which is about one-seventh of the estimated potential recharge of 4,500,000,000 gallons a year.

## GROUND-WATER RESERVOIRS

### General Statement

The complex Pleistocene geology of Surrey Municipality has resulted in the formation of three main types of ground-water reservoirs, namely, perched free ground water, perched confined ground water, and floating groundwater, the last probably also perched. The term confined is used to refer to ground water confined vertically but not necessarily horizontally.

Perched ground water occurs in a saturated zone separated from the main body of ground water by impervious sediment. Perched water bodies in Surrey generally rest on clay, stony clay, or till. They may be confined or free.

Free ground water is the water in interconnected interstices in the zone of saturation down to the first impervious strata. It moves under the control of the water-table slopes.

Floating ground water is defined as a body of fresh ground water floating on salt ground water. This happens because fresh water has a specific gravity of 1.000 and sea water a specific gravity of 1.025. Floating water bodies are found near the sea.

The classes of wells referred to in this report are as follows: flowing artesian wells, non-flowing artesian wells, and non-artesian wells. Flowing artesian wells are those in which the water is under sufficient pressure to flow above the surface of the ground at the well. Non-flowing artesian wells are those in which water is under hydrostatic pressure sufficient to raise it above the level at which it was encountered in the well, but not above the level of the ground. Non-artesian wells are those in which the water does not rise above the surface of the water body. Both artesian and non-flowing artesian wells are found in Surrey when perched confined water reservoirs are pierced. Non-artesian wells are found mainly in the perched free-water reservoirs but there are also some in vertically confined water bodies that are open horizontally.

Throughout much of Surrey Municipality the writers have noted that in most places the piezometric surface, or the surface to which ground water will rise in an artesian well, of the several confined perched ground-water bodies occurs at practically the same elevation in any one place.

It has also been noted that the surface of the extensive free ground-water bodies and the non-artesian confined ground-water bodies underlying some of the uplands corresponds approximately to the piezometric surface of the confined artesian ground-water bodies in the same area. The combined surface of the ground water in the artesian and non-artesian wells shows a marked parallelism with the ground surface. These features suggest that the water-tables are interconnected. The record of adjoining wells over several years and the record of new wells would seem to confirm this statement.

## Perched, Free Ground-water Reservoirs

Large areas of Surrey are underlain by perched, free ground water. The Newton stony clay, which mantles most of Newton, Clayton, and Sunnyside Uplands, although nearly impervious, is capable of passing small quantities of water everywhere, especially where it contains small lenses of coarser material. It thus forms a perched, free ground-water reservoir of very limited storage capacity and shallow wells dug in it will yield a small supply of domestic water. Yields may be up to several hundred gallons a day but generally are under 100 gallons. These wells probably act mainly as natural cisterns, that is, they fill up during the rainy season, and if placed to take advantage of local slopes, they catch natural drainage during the dry periods. As the water-table lowers during dry periods they tend to go dry, especially if they are too shallow or have too limited a storage capacity. Perched, free ground water is also present in the lowland areas where Sunnyside sand overlies Cloverdale clay. These areas are suitable for dug wells but the water-table fluctuations are usually large.

The Campbell Upland, which is underlain by Abbotsford outwash sand and gravel, contains a large, perched, free ground-water reservoir that may be reached by 25-foot wells. Wells in this area yield copious amounts of water and have a seasonal fluctuation of less than 3 feet. The low water period is in the early autumn.

## Perched, Confined Ground-water Reservoirs

Perched, confined ground-water bodies, including non-artesian and artesian reservoirs, are found within 375 feet of ground surface throughout 95 per cent of Surrey Municipality. As many as three water bodies have been pierced by a single 350-foot well. The following deposits serve as aquifers for ground water in the area; Colebrook, Sapperton, Nicomekl, Semiamu, Point Grey, Lynn, and pre-Seymour gravel and sand.

The most easily reached and widely developed aquifer is in the Colebrook outwash gravel, which underlies Surrey till. Its position cannot always be determined before development because the gravels appear to occupy channels in the sand. However, it is normally present near the crests of the main upland slopes, and near the toes of some of these slopes, and these areas are, consequently, most favourable for relatively shallow wells from 30 to 100 feet deep. Other gravel deposits form equally good aquifers but are generally deeper or more limited in extent.

## Floating Ground-water Reservoirs

These aquifers are unimportant sources of potable water in Surrey Municipality. They exist in the Mud Bay region where brackish water is available within 25 feet of the surface in Richmond Delta sand.

# CHAPTER IV

## PRINCIPLES OF WELL DEVELOPMENT

### GENERAL STATEMENT

The main purpose of this section is to draw the attention of engineers, drillers, and prospective well owners in Surrey Municipality to certain fundamental principles of ground-water recovery and well use, that they may know the problems that exist and the safeguards or corrective measures that are being employed elsewhere. Those interested in the subject of well construction may obtain much valuable information from drillers magazines and from some of the books listed in the References on page 8 of this report.

Basically, wells serve only one purpose and that is to tap the ground-water reservoir and make economically available the required amount of water. Economic factors and the ability of the driller and his equipment govern how efficiently and how long a well will produce. A well should be more than a hole in the ground or a hole lined with some type of casing. It must be developed properly before it can be of lasting and effective use. For example, wells that pump sand will eventually fail because a cavity will form at the bottom of the casing, which will collapse in time and greatly decrease or even stop the flow.

Two important and related factors to be constantly borne in mind are the influence of the well, due to draw-down, on the surrounding area, and its capacity to produce. The former is the effect of the 'cone of depression' and the latter is the 'specific capacity' of the well.

Cone of Depression. When a well is pumped the water level may fall around the well due to the dewatering of the water-bearing or storage material. The shape of the water surface around the well is, then, that of an inverted cone,

which is known as the 'cone of depression'. The size and shape of this cone of depression is controlled by several factors, such as the rate of pumping, the permeability or water-yielding capacity of the water-bearing material, and the slope of the water-table in the vicinity of the well. For example, if the pumping rate is high and the water-bearing sediment is coarse, then the cone of depression will affect a large area of the water-table, but the height of the inverted cone will be relatively small. Under these conditions many neighbouring wells may be affected. When the pumping is stopped the dewatered area normally fills up again. On occasions a small lowering of the water-table may be more less permanent.

Specific Capacity. The 'specific capacity' of a well is its rate of yield per unit of draw-down, usually stated as the number of gallons per minute, per foot of draw-down. The specific capacity of a well should be known, especially when large flows are demanded, because it tells the well owner how much water he can expect from the well and the depth from which he may have to pump. When testing for specific capacity it is important to continue pumping until the water level remains constant. Under some conditions it may take several days for this to happen and the equilibrium of the cone of depression to be established.

## TYPES OF WELLS

### General Classification

There are four main types of wells: dug, bored, driven, and drilled. Each type has its special use and function under certain conditions. In some areas of the municipality one type may prove more valuable than another. The factors that determine the type of well to use are: depth to water, characteristics of the sediments from ground surface to the water, characteristics of the water-bearing sediments, the static level of the ground water, the

amount of water required, and the purchasing power of the prospective owner. Drilled wells (which are cased in Surrey Municipality as the wells are in unconsolidated materials) may also be subdivided into open-end, screened, and gravel-packed.

Dug wells are of limited usefulness in Surrey Municipality because the depth to abundant water supply normally exceeds 30 feet and because the ground water beneath large areas of the municipality is under hydrostatic pressure, beneath a confining impervious bed. Where small quantities of water are required for domestic use, however, dug wells may give sufficient water at a minimum cost. The areas where dug wells may be expected to give good results are the terrace areas of the municipality. These areas are mainly covered by at least 10 feet of gravel, sand, and Newton stony clay. This last material, which is a marine deposit and easily dug, yields small quantities of water to wells. When locating a dug well attention should be paid to the irregularities of the ground surface. The well should be dug in the largest and flattest area available because low knobs on the terrace areas are normally composed of glacial till or hardpan from which little water can be expected other than stored water. On the lower slopes of the upland near the spring line, dug wells may pass through glacial till within 15 feet of the surface and get good reliable supplies of ground water from the underlying sand or gravel. These wells do not go dry because they tap one of the main ground-water reservoirs of the uplands that feed the springs. Another area where dug wells give good results is the large gravel terrace in the south-eastern section of the municipality known in this section as the Campbell Upland. Here the water-table is within 20 feet of the surface and the water is in outwash sand and gravel that covers the terrace.

In many parts of Surrey the presence of quicksand may make it difficult to dig a well the necessary few feet below the water level. The dug well must have several feet of water in it before it can be pumped at a rate greater than the domestic requirements of 200 gallons a day. Dug wells that reach running sand or quicksand may yield enough water if sand points are driven into the bottom of the well.

Bored wells, sunk by means of a hand auger or power auger, are not widely used and so will not be discussed in this paper.

Driven wells, which are constructed by driving a casing tipped with a drive point or sand point, are used in some areas of Surrey Municipality. These wells can produce adequate quantities of water for domestic and stock use. The advantage of this type of well over the dug well is that such a well can be driven some distance below the top of the water-table and the temporary cone of depression so formed may be sufficient to allow the required amount of water to be pumped.

In the lower Campbell Creek Valley wells driven in clay and soft stony clay will produce water from a depth up to 55 feet. The main difficulty in this area is caused by stones in the lower clays, which stop the driving of the well. Those areas where there is ground water in sand appear well suited for driven wells.

Drilled wells are widely used throughout the municipality. Cable tool rigs appear to be best suited for drilling in the lower Fraser Valley. Those who have used rotary rigs have experienced great difficulties where heavy outwash gravels were encountered, and there are many unsatisfactory wells that might have yielded several times their present production over long periods of time had they been properly constructed. As mentioned earlier, cased drilled wells may be classified according to the opening provided for water to enter.

Open End Wells. These wells allow water to enter through the open end of the casing. No screen or other device is used to keep sand from entering the well. The open end, cased, drilled well is widely used throughout the municipality but is unsatisfactory in many places where the water-bearing sediment is sand. Under such conditions the only alternative to doing a proper development job is to keep the production of the well very low so that sand will not move up the well with the water.

Screened Wells. These are wells with a screen at the lower end to prevent the passage of fine sand into the well. A screen should be designed to allow the maximum flow of water without permitting the entrance of fine sand during production. The screen must be designed so that it will withstand development and surging without clogging.

In water-bearing materials that contain sand and fine gravel mixed with silt, a screened well may be developed by removing the fine sediment and concentrating the coarser material around the screen. This is done by surging the water in the well. After the well has been surged for a suitable length of time the fines are bailed from the inside of the screen. It is important to remove all the fines inside the screen because a screen normally operates most effectively near the bottom. The process should be repeated until the well, when pumped, will not produce sand, and may take a few hours or several weeks depending upon the size of the well and the composition of the water-bearing sediment. In wells of small yields the over-pumping method of development may be used. The well is pumped at an excessive rate until it ceases to pump sand. This method is not entirely satisfactory but it will give sufficient development for many low yield wells. Another method of development is known as back-washing, where the pump is operated at its maximum capacity and periodically stopped and the foot check value released. The

water then rushes back into the well and agitates the sediment around the screen. The importance of developing sand wells properly is becoming better appreciated by those using ground water for municipal, industrial, irrigational, and farm use, and drillers would be wise to study the art and refine their techniques because proper development is an absolute necessity for large wells.

Gravel-packed Wells. Under certain conditions, especially where no particles coarser than medium sand are involved, a well may be developed by artificial gravel packing around the outside of the screen. The gravel is placed outside the final casing and screen, that is, between the screen and the water-bearing sediment. This may be effected through pilot holes or through a hole drilled larger than the diameter of the final well. Gravel-packed wells are satisfactory under certain conditions, especially when the water-bearing sediment is medium to fine sand.

# CHAPTER V

## GROUND-WATER GEOLOGY OF SURREY MUNICIPALITY

The topographic units described below are merely convenient subdivisions for the discussion of the ground-water geology of Surrey Municipality. The aquifers or ground-water reservoirs discussed in this section are those within 375 feet of ground surface. These bodies will yield a constant supply of potable water to properly developed, drilled, driven, or dug wells.

### NEWTON UPLAND

Water for the western and northwestern parts of Newton Upland is presently supplied by a part of the Surrey Municipal Water Works, which obtains it from the Greater Vancouver Water Board. This water comes from Coquitlam Lake and reaches the area via a main at South Westminster. The existence of this supply system made it almost impossible to obtain useful information about the ground-water geology of that part of Newton Upland west of King George Highway. The municipality installed the distributing system to handle surface water as there was no information available on the possibility of an adequate ground-water supply. However, the wells in secs. 17 and 20, tp. 2, show that confined artesian ground water is present. The well recorded as 2-17-1 struck water in Colebrook gravel within 50 feet of ground surface and yielded a supply in excess of 2,000 gallons an hour. Extrapolation of the results obtained from other parts of Newton Upland and from other uplands suggests that ground water is present in this area in large quantities.

The sands and gravels of the Colebrook outwash and the sands of Sapperton sediments, Nicomekl silt, and Point Grey beds are the main developed aquifers beneath Newton Upland.

## Water Reservoirs

At least one free and three confined ground-water reservoirs, vertically below one another, are present in much of Newton Upland. They are believed to be interconnected as the height to which the water rises in the wells seems to be about the same, regardless of which body is supplying the water. Possibly the explanation may be that all the porous sediments below the upper water body are completely saturated.

The undulations in the surface formed by the height at which the water stands in the wells in that part of the area where information is available closely parallel the topographic surface. In those parts where the elevation of the ground is over 175 feet this surface has a more subdued topography than that of the ground above it, and its slope varies between 25 and 75 feet a mile. In the northeastern parts of Newton Upland the crest of this surface is southwest of the topographic ridge. Below ground elevations of 150 feet the surface of the well water drops steeply, at slopes between 300 and 500 feet a mile, except in Mahood Creek Valley where more gentle slopes of 100 to 200 feet a mile are present. In places near the 100-foot topographic contour a ground-water cascade is present. There the surface of the well water drops 75 feet in about one-twentieth of a mile. A spring line also exists near this contour. These features indicate the presence of an impervious bed or beds, probably the Semiamu till, at this elevation. However, the lack of good exposures and the similarity between Semiamu and Surrey tills in small outcrops makes it impossible to be sure. The springs issue from areas where Surrey till is breached and an alternative hypothesis is that they are the result of the intersection of the surface ground-water body and the topographic surface.

The water reservoirs of Newton Upland apparently suffer only slight seasonal fluctuations. Several well owners report that their wells contain more water during the summer drought than in the winter rainy season. This may be caused by a lag in the movement of ground water from the recharge areas, which are covered by Newton stony clay, to the water reservoirs. Climatic conditions demand maximum recharge during the late autumn, winter, and early spring with little or no recharge during the late spring, summer, and early autumn. The existence of high water in wells during the summer and low water during the late autumn and early winter shows that the water reservoirs are about 4 months behind the seasonal variations in precipitation.

## Ground-water Recharge and Discharge

The main recharge areas of Newton Upland are those areas above 260 feet in elevation, particularly the marine terraces close to 260 and 305 feet, which are covered by Newton stony clay. Small upland areas above 250 feet are present from which the Semiamu and Surrey tills have been eroded and Colebrook outwash or lower deposits are at or near the surface. It is difficult in the field to outline these areas in detail but observations show that such areas do exist. The Newton stony clay deposits, although superficially similar to till, transmit limited quantities of water. This water moves along planes of sub-stratification and in the lenses of silt and sand.

The recharge area north of Mahood Creek is estimated to be 4 square miles in extent. The total recharge area of the upland is estimated to be 10 square miles.

The following method is used for estimating the amount of recharge in the clay-mantled upland areas. One inch of rain on 1 square mile contains

approximately 14,520,000 imperial gallons. The average annual precipitation of Surrey Municipality is about 40 inches. Conservatism demands that the estimate of run-off, evapotranspiration, and percolation of ground water into adjoining areas be assumed to be 90 per cent. Thus, 10 per cent, or 4 inches of rainfall, is available to recharge the aquifers, and 58,080,000 imperial gallons of water can safely be assumed to be available per square mile of recharge area annually. The recharge from Newton Upland can, therefore, be estimated to be about 580,000,000 imperial gallons a year. Inflow from adjacent areas is believed to be negligible to the aquifers within 375 feet of ground surface of Newton Upland.

Serpentine River and its tributaries are effluent during the periods of low rainfall, but data are not sufficient to give an estimate of the amount of ground water lost to these streams.

## Recovery of Ground Water

Drilled and dug wells recover the ground water of the upland. The drilled wells are non-flowing artesian wells and obtain their water from perched, confined ground-water bodies. The dug wells are mainly non-artesian wells obtaining their water from perched, free ground-water bodies and to a lesser extent perched, confined ground-water bodies. A few are, however, non-flowing artesian. No well in the municipality has as yet been properly developed. Most dug wells do not penetrate more than a few feet into the aquifers so that at best only a small cone of depression can be created around them. The drilled wells consist of either wholly or partly cased holes that are neither gravel packed nor screened. The drillers apparently hoped that a natural arch would form at the bottom of the hole, but even if such an arch were to form it would be unstable. Wells in

Colebrook gravels, however, become gravel packed by normal pumping. The absence of properly developed wells makes it impossible to obtain an estimate of maximum yields to be expected from this deposit.

## CLAYTON UPLAND

The ground-water geology of Clayton Upland is similar to that of Newton Upland.

The Colebrook outwash, Nicomekl silt, Sapperton sediments, and Point Grey beds form the main aquifers of the Clayton Upland, the Colebrook being present along the slopes.

### Water Reservoirs

In the eastern part of this upland the piezometric surface reflects the topography. This surface apparently has gentle slopes above an elevation of 250 feet, but near the 200-foot topographic contour the slope increases to about 400 feet a mile. Below 100 feet, the slope flattens to between 35 and 75 feet a mile. The steep part of this surface may be likened to a ground-water cascade similar to that in Newton Upland. The projected surface of the static levels of the wells (the piezometric surface) slopes towards Nicomekl Valley more gently than towards Serpentine Valley. A narrow ground-water "ridge" extends westward from the main part of Clayton Upland across the topographic saddle north of Cloverdale village to the small upland area west of the village.

### Ground-water Recharge and Discharge

A recharge area is present on the subdued terrace above an elevation of 260 feet. This infiltration area is believed to be 3 miles square in Surrey Municipality with Newton stony clay mantling most of it. The total infiltration

area for the whole upland is probably 5 square miles. This would allow the infiltration of 290,400,000 imperial gallons a year into the entire Clayton Upland and 174,240,000 imperial gallons a year into that part of it in Surrey Municipality.

The natural discharge is from springs, some of which feed small streams tributary to Nicomekl and Serpentine Rivers.

## Recovery of Ground Water

Ground water is recovered by numerous privately drilled and dug wells on the upland slopes. As will be seen from the tables, both non-flowing artesian and non-artesian wells occur and obtain their water from perched confined, and perched free ground-water reservoirs. These wells are not properly developed so that yields are low in most wells.

## SUNNYSIDE UPLAND

Hydrologic data for Sunnyside Upland is insufficient to allow more than a general discussion of the ground-water conditions.

On this upland the main aquifer is also the Colebrook outwash, but pre-Surrey sands produce considerable quantities of water even to the poorly developed wells of the upland.

## Water Reservoirs

The projected surface of the static levels in the wells slopes abruptly downward on all sides from the centre of the upland. This is because the upland itself slopes steeply on all sides, particularly to the south and west where waves have cut cliffs up to 125 feet high. A spring line is present along these cliffs above Semiamu till and varved clays, at an elevation of about 90 feet. The slopes range from 350 to 5,000 feet a mile along the southern face of the upland.

## Ground-water Recharge and Discharge

The main recharge area for Sunnyside Upland is about 4 square miles in extent and is covered by Newton stony clay. It ranges in elevation from 260 to 325 feet. Recharge from the eastern knob of the upland is believed to be negligible. Inflow from the Campbell Upland is believed to recharge the water reservoir below 75 feet in the eastern parts of the upland. If the assumption made for Newton Upland is correct the annual recharge of the water bodies, exclusive of inflow, is estimated to be about 230,000,000 imperial gallons.

The natural discharge is from springs along the upland slopes close to 90 feet above sea-level. More springs issued from the southern than from northern slopes.

## Recovery of Ground Water

Dug and drilled non-flowing artesian and non-artesian wells recover the ground water from the perched confined and free ground-water reservoirs of the upland. None of these wells are fully developed. Four water concerns, using the ground water of Sunnyside Upland, presently supply water to the upland's inhabitants. These four concerns are the White Rock Water Works Company, Limited, the Crescent Beach Water Works, Limited, the Kensington Prairie Water Users Community, and Surrey Municipality Water Works.

The White Rock Water Works Company is situated in the village of White Rock at the base of the southern slope of Sunnyside Upland in sec. 10, tp. 2. It supplies the village and the adjoining areas to the north and west. In 1949 it supplied 1,750 domestic and 76 commercial users. The water is obtained from three drilled wells, Nos. 2-10-1, 2-10-2, and 2-10-3. These

wells, two of which are 8 inches in diameter and one of which is 6 inches in diameter, are flowing artesians with a static water level a few feet above ground surface. They are not developed beyond having slotted casings and having been surge pumped. Sand and gravel aquifers are present at approximate elevations of 50, 100, and 150 feet below sea-level. These aquifers are probably outwash sediments related to the advance of Semiamu or Seymour glaciers. The natural flow of each well is about 7,500 imperial gallons an hour, but with pumping to a near static level of 11 feet, the three wells together can produce over 900,000 imperial gallons a day. The maximum amount supplied up to the time of the writer's visit was 650,000 imperial gallons a day, at which time many water pipes were broken because of a deep frost. The manager, Mr. W. E. Johnson, believes that the wells could supply 1,000,000 imperial gallons a day. Although the wells are less than 1/8 mile from tide-water and are obtaining water from up to 150 feet below sea-level, no salt water has invaded the wells. An analysis supplied by Mr. Johnson reported only 76 p.p.m. chloride ion.

The Crescent Beach Water Works, Limited, which is situated on the northeast point of Sunnyside Upland in sec. 19, tp. 2, supplied 386 domestic, 3 commercial, and 1 industrial user in 1949. It derives its water from one drilled well situated 10 feet above sea-level at the toe of the upland slope. The well is 8 inches in diameter and is reportedly 28 feet deep. This well produces an estimated maximum of 40,000 imperial gallons a day.

The Kensington Prairie Water Users Community was established by the residents near a spring area in NE. 1/4 sec. 24, tp. 2. Twenty families are supplied by this system. The springs feed a small reservoir and issue from sands underlying Surrey till at an elevation of 48 feet. Numerous other springs are present in this area between Blake and Coast

Meridian roads. Surrey till outcrops on three sides of the springs so that surface contamination from run-off water could be readily prevented by digging ditches in the till to the west, south, and east of the spring. These springs could possibly produce 500,000 imperial gallons a day. However, because many of the springs issue from beneath forest litter, clearing would be necessary before a reliable estimate of flow could be made.

Surrey Municipal Water Works are presently constructing a water system to supply the eastern highland area of Sunnyside Upland. The water for this system will come from three or more drilled wells on the south slope of the upland in sec. 7, tp. 7. These wells are recorded as 7-7-2. They are undeveloped, 10-inch cased wells, and obtain water from an elevation of 110 feet below sea-level from medium to fine grey sand that probably belongs to the Point Grey beds. The quantity of ground water flowing from these wells is approximately 500 imperial gallons an hour. The three wells produce about 36,000 gallons a day by natural flow.

The total amount of water that can be produced by these four water works is approximately 575,000,000 imperial gallons a year. The estimated recharge at the surface of the upland was 230,000,000 gallons a year. Thus, either the estimated rate of infiltration is too low or there is considerable inflow to the water reservoirs near the base of the upland slopes, where these water works obtain their supply. The writer believes the latter to be the case, the inflow coming from Campbell Upland.

## CAMPBELL UPLAND

Campbell Upland is underlain by Abbotsford outwash sand and gravels. It has an area of 10 square miles of which only 3 square miles are in Surrey Municipality.

## Water Reservoirs

A perched, free ground-water reservoir conforms closely to the topography of the terraced upland. The slope of the table away from the terrace front is less than 25 feet a mile, whereas near the front and adjacent to the valley of Anderson Creek the slope steepens to 200 feet a mile. East of lower Campbell Creek Valley the slope is 50 feet a mile.

Observations made in a gravel pit on Hunter Road in SE. 1/4 sec. 22, tp. 7, during the 1951 drought, showed that the water-table dropped 3 feet during July and August. The water remained at the lowered level until November in spite of 2 inches of rain during September and October. This was not enough to soak thoroughly the 15 feet of gravel overlying the water-table.

The Abbotsford outwash forms the main aquifer of the area, but towards the northwest slope of the terrace water also comes from older deposits.

## Ground-water Recharge and Discharge

Campbell Upland is ideally suited for an infiltration area. The flat topography of the terraced upland and the coarseness of the outwash suggest that at least 60 per cent of the precipitation that falls upon this area will infiltrate to the water-table. If this is correct, about 3,500,000,000 imperial gallons will enter the aquifers each year from the whole area of the upland. Inflow from the uplands to the east is also large.

Anderson Creek and the lower part of Campbell Creek are effluent streams during the summer season. Dug, non-artesian wells, up to 40 feet deep, are presently being used to recover the ground water.

## CAMPBELL CREEK LOWLAND

Campbell Creek Lowland receives its perched, confined artesian ground water from the inflow from Campbell Creek Terrace and a minor amount from Sunnyside Upland.

### Water Reservoirs

The artesian water bodies beneath the lowland have a relatively flat piezometric surface that slopes westward, down the valley, at about 12.5 feet a mile between hydrostatic heads of 75 and 50 feet. To the east, near Campbell Upland, the slope is 50 feet a mile and near Sunnyside Upland the slope averages 150 feet a mile. Except in very dry summers a shallow, perched, free ground-water reservoir occurs in the Sunnyside sands occupying the Campbell River Lowland.

Pre-Surrey sands form the aquifers beneath this lowland.

### Ground-water Recharge and Discharge

No recharge area exists beneath this lowland and most of the ground water comes from Campbell Upland, with a minor amount from Sunnyside Upland. Campbell Creek flows over relatively impervious Cloverdale clay and has no apparent effect upon the water-tables.

The water bodies beneath Campbell Creek Lowland have no apparent natural discharge. Flowing artesian wells that are undeveloped and allowed to flow constantly provide an artificial discharge, and an estimated 13,000,000 imperial gallons a year from these wells is wasted.

The area is developed almost entirely by drilled wells obtaining flowing artesian water from perched, confined ground-water reservoirs.

## NICOMEKL-SERPENTINE LOWLANDS

This lowland area, which separates Newton, Clayton, Sunnyside, and Campbell Uplands is an area of flowing-artesian wells.

### Water Reservoirs

Perched, flowing artesian ground-water reservoirs are the most important aquifers in this lowland. The combined piezometric surface on these artesian bodies is relatively flat and trends down the valleys of Serpentine and Nicomekl Rivers with a gradient of about 4 feet a mile. The centre line of the piezometric surface is midway between Newton and Sunnyside Uplands in the Mud Bay region, but is closer to Clayton Upland in both the upper Nicomekl and Serpentine Valleys. A divide is present on the piezometric surface near where the Trans-Canada Highway crosses the upper Serpentine Valley. Northeast of this divide is a depression in which the piezometric surface drops about 20 feet. Except in very dry summers a shallow, perched, free ground-water body occurs in the Sunnyside sands occupying the Nicomekl-Serpentine Lowland.

The main aquifers are pre-Surrey, probably Nicomekl, Sapperton, and Point Grey sands. Near Cloverdale village some wells penetrate Colebrook gravels.

### Ground-water Recharge and Discharge

No surface recharge areas are present in the Nicomekl-Serpentine Lowland. Recharge for the aquifers is by means of inflow from the adjoining uplands. The Campbell Creek Upland furnishes most of the ground water of these lowlands. In the upper Serpentine Valley the shape of the piezometric surface suggests that more inflow comes from Newton Upland than from Clayton Upland.

No obvious natural discharge takes place in this lowland area. Nicomekl and Serpentine Rivers, in the lowlands, are perched and are, therefore, neither effluent nor influent.

## Recovery of Ground Water

Ground water in this Lowland is recovered from a number of flowing artesian wells. The wells are undeveloped and flow continuously the year round. The resulting waste of ground water is estimated at about 13,000,000 imperial gallons a year.

## CONCLUSIONS AND RECOMMENDATIONS

The recharge areas for the ground-water reservoirs of Surrey Municipality are situated on Newton, Clayton, and Sunnyside Uplands above an elevation of 260 feet, and on Campbell Upland. A conservative estimate suggests that 10 per cent of the precipitation infiltrates to the ground-water reservoirs from the first three uplands and that 60 per cent infiltrates from Campbell Upland. That is, about 4,500,000,000 imperial gallons a year recharge the water reservoirs artesian wells does not re-enter the confined ground-water body but drains directly to the sea. The present consumption of ground water is probably about 600,000,000 gallons a year, based on the estimate that every inhabitant of the municipality uses 50 gallons a day. The remaining 3,900,000,000 imperial gallons a year of the estimated recharge would supply enough water to irrigate 25 square miles of land with 10 acre-inches during the summer drought period.

The present survey is preliminary and the figures given must be considered as estimates. Only those water reservoirs within 375 feet of ground surface have been investigated and, as the unconsolidated deposits have a total thickness of about 1,350 feet, other aquifers may exist at greater depths.

Carefully engineered development would supply Surrey Municipality at reasonable cost with enough ground water for the present inhabitants. By careful planning, supplies of ground water for irrigation or domestic purposes could be developed to keep pace with the increase of population, with industry, and farming. To bring surface waters to a region where the population is grouped in small scattered centres, as is the case at present in most of Surrey Municipality except Whalley and White Rock, involves the construction of large and costly mains and a high cost per capita. Under such conditions the use of ground water may be much more economical. In a densely populated area, on the other hand, the per capita cost of surface water supply is relatively low.

The writers believe that the ground water should be fully and properly developed during the initial growth of Surrey Municipality, and that only after the municipality is densely populated with large urban areas should surface water be brought in by mains. The ground water could then be used for irrigating farms, and for industrial cooling and processing.

# CHAPTER VI

## QUALITY OF WATER

The chemical character of the ground water in Surrey Municipality is indicated by the analyses of 8 samples given in the table on page 46 . These samples were collected from different water-bearing formations and are believed to represent the various types of water available to wells and springs in the municipality. The analyses were made by the Mines Branch, Department of Mines and Technical Surveys, Ottawa.

### CHEMICAL CONSTITUENTS IN RELATION TO USE

The following discussion has been adapted from publications of the Geological Survey of Canada, the United States Geological Survey, and the State Geological Survey of Kansas.

Dissolved Solids (residue on evaporation). As ground water slowly percolates through the rocks near the earth's surface, it dissolves part of their constituent elements. The kind and quantity of these elements present in the water determine its suitability for various uses. Water containing less than 500 parts per million of dissolved solids is considered to be most satisfactory for domestic use. People may, through long use, become accustomed to water containing slightly more than 1,000 parts per million of dissolved solids, but generally such water is unsuitable for most uses.

Only two of the samples contained dissolved solids in excess of 500 parts per million, but both were well below the critical 1,000 parts per million point. One sample came from the lower Nicomekl Valley and is believed to represent the ground water from sand lying about 150 feet below sea-level in the lower Nicomekl and Serpentine Valleys. The other sample

came from a sand about 135 feet below sea-level in the lower Campbell Creek Valley, and is believed to represent the ground water in the valley at this depth. The ground water along the slopes of the valley walls contains less dissolved solids.

Hardness. Hardness of water is caused chiefly by dissolved calcium and magnesium compounds. These materials possess a soap-destroying power as they must be precipitated as a sticky curd by the soap before a lather can form. Compounds of calcium and magnesium also form a coating on the insides of vessels in which the water is heated. The hardness of water in its natural state is known as total hardness, and may be divided into carbonate hardness, sometimes called temporary hardness, and non-carbonate hardness, or permanent hardness. Carbonate or temporary hardness, which is caused chiefly by calcium and magnesium bicarbonates, can be removed by boiling. Non-carbonate or permanent hardness, which is caused by the sulphates or chlorides of calcium and magnesium, cannot be removed by boiling but may be reduced by natural or artificial softeners. Water containing more sodium bicarbonate than bicarbonates of calcium and magnesium is soft, even though the total amount of dissolved salts is high.

Water having a total hardness of less than 50 parts per million is considered soft and needs no treatment. A hardness of between 50 and 150 parts per million is satisfactory for most uses, but it increases soap consumption and causes considerable boiler scale. The former may be an important consideration in commercial laundries. Where there is a municipal water supply it is more efficient to soften the water near the source to between 60 and 80 parts per million than for each user to soften his water by the use of excessive soap or special softeners.

The analyses on page 46 indicate that most of the ground water of Surrey Municipality has a total hardness of less than 100 parts per million. One noticeable exception is the water in the White Rock Water Works wells (1-10-1, 1-10-2, 1-10-3), which has a hardness of 115.6 parts per million. The Crescent Beach Water Works water has a hardness of 102.4 parts per million.

Silica ($SiO_2$). Silica may be derived from almost any sediment found in the Surrey area. It is an objectionable encrustant where the water is used for steam boilers. The ground waters sampled, however, contained a maximum of 30.8 parts per million of silica, which should not cause significant trouble to boilers.

Calcium (Ca). Water containing carbon dioxide dissolved from the air and soil attacks calcium carbonate more readily than the silicate minerals. The calcium is dissolved and held in solution by percolating ground waters as calcium bicarbonate. The chief sources of calcium for most water are limestone, gypsum, and dolomite, but it is believed that the ground water of Surrey Municipality obtains its dissolved calcium from the glacial drift as the glaciers eroded and transported limestone to the municipality from areas outside the lower Fraser Valley. Another source of calcium may be fossil beds that contain shells with a high calcium content. These occur in silts and clays in the unconsolidated deposits of the municipality. However, the fact that all waters tested showed about the same amount of dissolved calcium suggests that this element comes predominantly from limestone disseminated throughout the glacial deposits of the area.

Magnesium (Mg). The usual source of magnesium in ground water is dolomite. Water containing carbon dioxide will dissolve calcium and magnesium in about the same proportion as they are in the original rock,

commonly 30.4 parts of calcium to 21.7 parts of magnesium. It will be noted, however, that the samples do not show such a ratio between these two elements. This, plus the fact that dolomite is not found in the mountain areas bordering the lower Fraser Valley, strongly suggests that the magnesium does not come from this source. Another probable source is sea water.

Sodium (Na). Sodium salts such as sodium chloride, sodium sulphate, and sodium bicarbonate are found in all natural water. Their sources are rock salt interbedded with or disseminated through sedimentary bedrock formation, sea water either directly or from that enclosed in sediments of marine origin, feldspars, and certain other sodium bearing minerals. Moderate quantities of sodium salts have little effect upon the suitability of a water for ordinary uses, but water containing sodium in excess of 100 parts per million must be used with care in steam boilers to prevent foaming.

The highest sodium content was found in well No. 1-25-1, which contained 232.0 parts per million. This particular well was reported to have tapped a water-bearing sand 150 feet below sea-level. The water from this well is believed to be representative of the ground water beneath the lower Nicomekl and Serpentine Valleys to this depth. Water from a deeper aquifer such as that tapped by well No. 1-34-2 at 210 feet below sea-level, contained 164 parts per million sodium. Ground water from the lower Campbell Creek Valley is also relatively high in sodium, as represented by well No. 7-8-1, which contained 176 parts per million of sodium. From the above it would seem advisable to avoid obtaining industrial water from beneath the lower valleys of Nicomekl, Serpentine, and lower Campbell Creeks.

Potassium (K). Potassium is derived originally from alkaline feldspars and micas. It is of minor significance although beneficial to plants when water containing it is used for irrigation.

Sulphates (SO4). The main source of sulphate in ground water is gypsum ($CaSO_4, 2H_2O$) and metallic sulphides such as pyrite (FeS2). The latter is believed to be the chief source of the sulphate in the ground waters of Surrey Municipality. Above 350 p.p.m. sulphate is objectionable for irrigation and industrial uses.

Chloride (Cl). Chloride is derived from organic materials or from sea water either directly or indirectly. Chlorides in excess of 300 parts per million impart a salty taste to water. The chloride content of the samples of ground water analysed is below the critical amount that would adversely affect the water for domestic, irrigation, and industrial use.

Nitrate ($NO_3$). Nitrate is of minor importance in the use of ground water. Relatively large amounts may represent pollution by sewage, or drainage from barnyards, fertilized fields, or leguminous crops such as alfalfa. It is suggested that a bacteriological test be made of water showing a large nitrate content if it is to be used for domestic purposes. The analyses of the samples of ground water taken in Surrey Municipality show that nitrate is either absent or in quantity of less than 1 part per million. It is accordingly assumed that the drilled wells of the municipality are relatively free from pollution.

Carbonate($CO_3$). Carbonate forms a large percentage of the solid compounds held in solution by the average ground water. The two chief sources are the decomposition of feldspar and the solution of limestone by water containing dissolved carbon dioxide. The carbonate content is indicated in the analyses table as alkalinity and has been discussed in the section on hardness.

Bicarbonate ($HCO_3$). Carbon dioxide dissolved in water renders the insoluble calcium and magnesium carbonates soluble as bicarbonates. Boiling reverses the process by changing the bicarbonates into insoluble carbonates that precipitate out of solution and may form a coating on the sides of cooking utensils.

Analyses of Well Waters from Surrey Municipality, B.C.

| Location and No. of well | Dissolved solids | $SiO_2$ (col) | Ca | Mg | Na | K | $HCO_3$ | $SO_4$ | Cl | $NO_3$ | Hardness as $CaCO_3$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Total | $CO_3$ | Non-$CO_3$ |
| 1-10-NE., 1 | 182.0 | 16.8 | 29.0 | 10.5 | 80.0 | 2.9 | 134.2 | 12.8 | 21.0 | 0 | 115.6 | 115.6 | 0 |
| 1-12-SE., 5 | 328.0 | 30.8 | 10.0 | 0 | 127.0 | 4.0 | 305.0 | 9.1 | 10.0 | 0 | 25.0 | 25.0 | 0 |
| 1-24-NE., 1 | 140.0 | 13.2 | 29.0 | 2.8 | 6.8 | 1.8 | 119.6 | 6.2 | 1.0 | 0 | 83.9 | 83.9 | 0 |
| 1-25-NE., 1 | 740.0 | 26.8 | 24.0 | 0 | 232.0 | 10.0 | 334.3 | 43.2 | 206.0 | 0 | 59.9 | 59.9 | 0 |
| 1-34-NW., 2 | 490.0 | 20.8 | 20.1 | 3.0 | 164.0 | 10.2 | 302.6 | 21.4 | 104.0 | 0 | 62.3 | 62.3 | 0 |
| 7-8--NE., 1 | 652.0 | 10.4 | 22.0 | | 176.0 | 9.2 | 236.7 | 33.8 | 167.0 | 0.7 | 54.9 | 54.9 | 0 |
| 8-4 -NW., 3 | 90.0 | 6.0 | 20.0 | 1.1 | 4.3 | 1.0 | 73.2 | 2.5 | 0.5 | 0 | 54.4 | 54.4 | 0 |
| 8-31-SW., 4 | 314.0 | 28.0 | 21.0 | 0 | 82.0 | 6.3 | 217.2 | 39.5 | 28.0 | 0 | 52.4 | 52.4 | 0 |

All figures are in parts per million.

Errata to Accompany Well Records
of Surrey Municipality, B.C.

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Page 1. Tp. 1, Sec. 17, Well Nos. 3 and 4; for S.W. read N.W.

" 1. Tp. 1, Sec. 17, Well No. 5; for S.W. read N.E.

" 1. Tp. 1, Sec. 34, Principal Aquifer; under Depth to top; for 250 read 238.

" 2. Tp. 2, Sec. 6, Well Nos. 2 and 3; for S.W. read N.W.

" 4. Tp. 2, Sec. 27, Well No. 14, Description of Well, under Type; for Dug read Spr., and under Static Level, for -1 read 0.

" 5. Tp. 2, Sec. 36, Well No. 2, Yield; for 380 read 1380.

" 7. Tp. 8, Sec. 8, Well No. 2, Description of Well, under Static Level; for -2 read 0.

" 8. Tp. 8, Sec. 17, Well No. 4, Description of Well, under Depth; for 3 read ?.

" 8. Tp. 8, Sec. 20, Well No. 1, Description of Well, under Depth; for 20 read 25.

" 11. Blk. 5N, Rge. 1 W, under Lot,; for 24 read 23.

" 11. Blk. 5N, Rge. 1 W, Lot 35, Well No.; for 1 and 2 read 3 and 4 respectively.

" 11. Blk. 5N, Rge. 1 W, Lot 36, Well No.; for 1 read 2.

Stk. - livestock

## COMPILATION OF WELL DATA

The following information pertains to the Well Records of Surrey Municipality:

**Description of well:**

Type of well

- Bor. - bored
- Drl. - drilled
- Drn. - driven
- Dug - dug or hand augered
- Spr. - spring

Type of casing

- Conc. - concrete
- Iron - standard galvanized iron pipe
- Steel - standard black pipe
- Wood - wood cribbing

Collar elevation

The elevations are with reference to mean sea level, and are believed accurate to within 5 feet.

Static level

The static level is the level of the water with respect to the ground level at the collar of the well. Where the level is positive the water rises above the ground and the well is a flowing artesian.

**Principal aquifers:**

Depth to top

The depths are the reported depths to the top of the main water-bearing deposits, and are believed to be accurate within 5 feet.

Character of material

The character of the material is that observed by the writers or that reported and believed reliable.

**Water:**

Use

- Dom. - domestic
- Ind. - industrial
- Irr. - irrigation
- Pub. - public
- Stk. - livestock

Formations penetrated:

These are the deposits which are believed to be penetrated by the well.

A. Salish group sediments.

B. pre-Salish group sediments. (These are believed to be mainly Cloverdale, but may include some older sediments.)

C. Bose gravel.

D. Sunnyside sand.

E. Alouette gravel.

F. Cloverdale sediments.

G. Newton stony clay.

H. Abbotsford outwash.

I. Surrey till.

J. pre-Vashon group sediments, exclusive of Colebrook gravel.

K. Semiamu sediments.

L. Sapperton sediments.

N. Colebrook gravel. (Much of the gravel logged as Colebrook may be proven by deeper wells to be Semiamu).

O. Nicomekl silt.

P. Point Grey sediments.

Q. Quadra group sediments.

R. Lynn outwash.

S. Sisters varved clay.

T. Seymour till.

U. Seymour group sediments.

V. pre-Seymour group sediments.

CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 323

# GROUND-WATER RESOURCES
# OF
# GLOUCESTER TOWNSHIP
## CARLETON COUNTY
# ONTARIO

By
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OTTAWA
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ERRATA

Water Supply Paper 323

Page 151. Wells Nos. 3 and 3A; for Con. 4, O.F., lot 16, read Con. 5, O.F., lot 16.

" 199. Well No. 21; for Con. 1, O.F. lot 26, read Con. 2, O.F., lot 26.

" 201. Well No. 1; for Con. 1, O.F. lot 2, read Con. 2 O.F., lot 2.

" 203. For Well No. 23B, read 22B.

" 203. Below Well No. 23B insert the following data for Well No. 23:- Column 2-1 O.F.; 3-4; 4-D, 5-217; 6-13; 7-5M; 8-(Blank); 9-s/c; 10-(Blank); 11-S.cl; 12-D; 13-Sufficient

" 207. Well No. 85; for Con. 1, O.F. lot 2, read Con. 2, O.F., lot 2.

CONTENTS

PART I



PART II

Illustrations

# PART I

## INTRODUCTION

This report deals with the ground-water conditions of a township in the province of Ontario investigated by the Geological Survey of Canada. It is one of a series of ground-water reports on individual townships of Ontario.

All available information pertaining to the water wells in the area was recorded and water samples were taken for analysis. The elevation of the surface of the water in most of the wells was measured. As the ground-water conditions are directly related to the geology, the surface deposits were also studied and mapped. Descriptions of the bedrock geology are after A. E. Wilson[1].

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[1] Wilson, A. E.: Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec; Geol. Surv., Canada, Mem. 241, 1946.

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Thanks are here extended to the farmers and to the residents of communities throughout the township for their co-operation and willingness to supply information regarding their wells. Valuable assistance was also given by numerous contractors and well drillers in the area.

## PUBLICATION OF RESULTS

The essential information pertaining to ground-water conditions is being issued in reports covering each township investigated in the province of Ontario. These reports, as published, will be supplied directly to the proper municipal and township authorities. In addition, pertinent data on wells investigated in each township will be kept on file at Ottawa. The well record compilation sheets will not ordinarily accompany the reports, as for most areas they are too numerous. However, persons interested in individual wells may receive the information upon application to the Director, Geological Survey of Canada, Ottawa. For this information the request should specify lot, concession, owner's name, and approximate location of the well — at house, at barn, in pasture, etc.

With each report are maps showing the surface deposits that will be encountered in the area, and the positions of all wells for which records are available, together with the class of the well at each location.

## GLOSSARY OF TERMS USED

Alluvium. Recent deposits of clay, silt, sand, gravel, and other material deposited in lake beds and in flood-plains of modern streams.

Aquifer. A porous bed, lens, pocket, or deposit of material that transmits water in sufficient quantity to satisfy pumping wells, flowing artesian wells, and springs.

Bedrock. Bedrock, as here used, refers to the consolidated deposits underlying the glacial drift. South of a line drawn between Midland, on Georgian Bay, and Kingston, the bedrock consists mainly of sedimentary rocks such as limestone, shale, slate, and sandstone; north of that line the bedrock consists chiefly of hard, crystalline, granitic rocks.

Contour. A line drawn on a map that passes through points that have the same elevation above mean sea-level.

Continental Ice-sheet. The great, broad ice-sheet that covered most of the surface of Canada many thousands of years ago.

Escarpment. A cliff or relatively steep slope separating two level or gently sloping areas.

Effluent Stream. A stream that receives water from a zone of saturation.

Flood-plain. A flat part in a river valley ordinarily above water, but covered with water when the river is in flood.

Glacial Drift. A general term that includes all the loose unconsolidated materials that were deposited by the continental ice-sheet, or by waters associated with it. It includes till, deposits of stratified drift, and scattered boulders and rock fragments.

Several forms in which glacial drift occurs are as follows:

(1) End Moraine (Terminal Moraine). A more or less discontinuous ridge or series of ridges consisting of glacial drift that was laid down by the ice at the margin of a moving ice-sheet. The surface is characterized by irregular hills and undrained basins.

(2) Ground Moraine. A widely distributed moraine consisting of glacial drift deposited beneath an ice-sheet. The predominant material is till, which is clay containing stones. The topography may vary from flat to gently rolling.

(3) Kame Moraine. Assorted deposits of sandy and gravelly stratified drift laid down at or close to the ice margin. The topography is similar to that of an end moraine. Kame terraces are elongated deposits of this type laid down on the slopes of broad, flat-bottomed valleys.

(4) Drumlin. A smooth oval hill that has its long axis parallel with the direction of ice movement at that place. It is composed mainly of till.

(5) Esker. An irregular-crested ridge or series of discontinuous ridges of stratified drift deposited by a glacial stream that flowed beneath the continental ice-sheet or in deep crevasses within it. It is composed mainly of sand and gravel.

(6) Glacio-fluvial Deposits. Silt, sand, and gravel outwash deposited by streams resulting from the melting of the ice-sheet.

(7) Glacio-lacustrine Deposits. Clay, silt, and sand deposited in glacial lakes during the retreat of the ice-sheet. The clay deposits are commonly very distinctly stratified in layers a fraction of an inch to one or more feet in thickness; each layer is believed to represent deposition during one summer season and one winter season.

(8) Kame. An isolated mound or conical hill composed of stratified sand and gravel deposited in a crack or crevasse within the ice or in a depression along the ice front.

(9) Marine Deposits. Deposits laid down in the sea during the submergence that followed the withdrawal of the last ice-sheet. They consist chiefly of clay, silt, and sand, and have emerged beaches of sand and gravel associated with them.

(10) Shoreline. A discontinuous escarpment that indicates the former margin of a glacial lake or sea. It is accompanied by scattered deposits of sand and gravel located on former beaches and bars.

Ground Water. Sub-surface water in the zone of saturation below the water-table.

Hydrostatic Pressure. The pressure that causes water in a well to rise above the point at which it was first encountered.

Influent Stream. A stream that feeds water into a zone of saturation.

Impervious or Impermeable. Beds such as fine clays or shale are considered to be impervious or impermeable when they do not permit the perceptible passage or movement of ground water.

Pervious or Permeable. Beds are pervious or permeable when they permit the perceptible passage or movement of ground water, as, for example, porous sand, gravel, and sandstone.

Porosity. The porosity of a rock is its property of containing interstices or voids.

Pre-glacial Land Surface. The surface of the land as it existed before the ice-sheet covered it with drift.

Recent Deposits. Deposits that have been laid down by the agencies of water and wind since the disappearance of the continental ice-sheet; for example, alluvium in stream valleys.

Unconsolidated Deposits. The mantle or covering of loose, uncemented material overlying the bedrock. It consists of Glacial or Recent deposits of boulders, gravel, sand, silt, and clay.

Water-table. The upper limit of the part of the ground saturated with water. This may be near the surface or many feet below it. Water may be retained above the main water-table by a zone of impervious material; such water is said to be perched and its upper limit to be a perched water-table.

Wells. Holes sunk into the ground so as to obtain a supply of water. When no water is obtained they are referred to as dry holes. Wells yielding water are divided into four classes:

(1) Flowing Artesian Wells. Wells in which the water is under sufficient hydrostatic pressure to flow above the surface of the ground at the well.

(2) Non-flowing Artesian Wells. Wells in which the water is under hydrostatic pressure sufficient to raise it above the level of the aquifer, but not above the level of the ground at the well.

(3) Non-artesian Wells. Wells in which the water does not rise above the water-table or the aquifer.

(4) Intermittent Non-artesian Wells. Wells that are generally dry for a part of each year.

Zone of Saturation. The part of the ground, below a water-table that is saturated with water.

## GENERAL DISCUSSION OF GROUND WATER

Almost all the water recovered from beneath the earth's surface for both domestic and industrial uses is meteoric water, that is, water derived from the atmosphere. Most of this water reaches the surface as rain or snow. Part of it is carried off by streams; part evaporates either directly from the surface and from the upper mantle of the soil or indirectly through transpiration of plants; the remainder infiltrates into the ground to be added to the ground-water supplies.

The proportion of the total precipitation that infiltrates from the surface into the zone of saturation will depend upon the surface topography and the type of soil or surface rock. More water will be absorbed in sandy or gravelly areas, for example, than in those covered with clay. Surface run-off will be greater in hilly areas than in those that are relatively flat. In sandy regions where relief is great, the first precipitation is absorbed and run-off only commences after continuous heavy rains. Light rains falling upon the surface of the earth during the growing season may be wholly absorbed by growing plants. The quantity of moisture lost through direct evaporation depends largely upon temperature, wind, and humidity. Ground water in areas overlain by pervious material may be recharged by influent streams carrying run-off from areas overlain by relatively impervious material.

Because of the large consumption of ground water in settled areas, it may seem surprising that precipitation can furnish an adequate supply. However, when it is borne in mind that a layer of water 1 inch deep over an area of 1 square mile amounts to approximately 14,520,000 imperial gallons, and that the annual precipitation in this region, for example, is about 30 inches, it will be seen that each year some 435,600,000 imperial gallons of water falls on each square mile. Although it would be impossible to determine the annual recharge of the ground-water supply of the area, if it were assumed that only 10 per cent of the total precipitation, namely 43,560,000 gallons, is contributed to the zone of saturation, it will be seen that the annual recharge for the entire area would be a very large volume. The annual consumption of water in all areas investigated is not known, but an estimate for some restricted areas, based on per capita consumption, shows it to be only about one-tenth of the annual recharge as estimated above.

In most regions of the world where precipitation is effective there is an underground horizon known as the ground-water level or water-table, which is the upper surface of the zone of saturation. The water-table commonly is a subdued replica of the surface topography. The water that enters from the surface into the unconsolidated deposits and rocks of the earth is drawn down by gravity to where it reaches the zone of saturation or comes in contact with a relatively impervious layer. Such a layer may stop further downward percolation, resulting in perched water and creating a perched water-table. If a water-table is at or near the surface, there will be a lake or swamp; if it is cut by a valley, there will be a stream in the valley. The terms influent and effluent are used with reference to streams and their relation to the water-table. An influent stream flows above the water-table and feeds water into the zone of saturation; an effluent stream flows at or below the water-table and receives water from the zone of saturation. An effluent stream may become influent and eventually dry up if the water-table is lowered sufficiently. The ground water in the zone of saturation is almost constantly on the move percolating towards some point of discharge, which may be a spring or a pumping well.

All rocks and soils are to some degree porous, that is, the individual grains or particles of which they are composed are partly surrounded by minute interstices or open spaces that form the receptacles and conduits of ground water. In most rocks and soils the interstices are connected and large enough for the water to move from one opening to another. In some rocks or soils, however, they are largely isolated or too small to allow movement of water. The porosity of a material varies directly with the size and number of its interstices, which in turn depend chiefly upon the size, shape, arrangement, and degree of assortment of the constituent particles.

Horizons within the earth's crust of fine-grained rock such as shale, limestone or dolomite, or unconsolidated clay or silt, may have such small interstices that the contained water will not flow readily and wells penetrating them may derive little or no water from them. Such horizons are considered impervious. Beds of more coarse-grained materials such as sand, gravel, or sandstone have greater porosity and readily yield their waters to wells. They are called water-bearing beds or aquifers. A clean water-bearing gravel is one of the best sources of water. This is true whether the water is derived from the zone of saturation or from a bed of gravel confined above, between, or below beds of less pervious material.

Consolidated rocks usually considered to be impervious may sometimes produce water in relatively good supply from openings within them of primary or secondary origin. Those of primary origin, original interstices, were created when the rocks came into existence as a result of the processes by which they were formed; e.g. bedding planes, and intergranular spaces. Secondary interstices comprise joints and other fracture openings, solution openings, and openings produced by several processes of minor importance, such as the work of plants and animals, mechanical erosion, and recrystallization; all of these involve movement of a type that acted after the consolidation of the rock. The most important interstices with respect to water supplies are the original interstices, next to them are the fracture and solution openings.

The most common wells and those that in drift-covered areas yield the largest aggregate supply of ground water are water-table wells. These are wells that derive their water from the zone of saturation. Many shallow wells become dry during the late summer and winter, or during periods of extreme drought. In most cases this is due to the lowering of the water-table below the bottom of the well. The grouping together of a number of water-table wells

within a limited area will also lower the yield of any one of the wells. This is especially true of water-producing formations of low permeability. When a well penetrates an aquifer confined by impervious beds, water will be forced upward by hydrostatic pressure exerted at the point where the well enters the aquifer. If the hydrostatic pressure is great enough to force the water to or above the surface, a flowing well is formed.

Springs are formed where the water-table, or some water-bearing aquifer, outcrops at the surface of the ground. The water emerging from water-table springs is free-running water flowing down the gradient of the water-table. In many cases these springs occur as slow seeps along the steeper slopes of stream valleys. A large number in one area could maintain a swamp. A group of permanent springs occurring in one area could provide sufficient water to maintain a lake or form the source of a stream.

## GENERAL DISCUSSION OF GROUND-WATER ANALYSIS

The mineral content of ground water is of interest to many besides those industries seeking water of specific quality. Both the kind and quantity of mineral matter dissolved in natural water depend upon the texture and chemical composition of the rocks with which the water has been in contact. Pollution is caused by contact with organic matter or its decomposition products. Analyses of well waters for mineral content are made by the Mines Branch, Department of Mines and Technical Surveys, Ottawa.

In any given area, an attempt is made to secure samples of water representative of all major aquifers. The quantities of the various constituents for which tests are made are given as "parts per million", which refers to the proportion by weight of each constituent in 1,000,000 parts of water.

The following mineral constituents are those commonly found in natural waters in quantities sufficient to have a practical effect on the value of the waters for ordinary uses:

Silica ($SiO_2$) may be derived from the solution of almost any rock-forming silicate, although its chief source is the feldspars. It is commonly determined in the analysis of water for use in steam boilers, as silica is classed as an objectionable encrustant.

Calcium (Ca). The chief source of calcium dissolved in ground water is the solution of limestone, gypsum, and dolomite. The common compounds of calcium are calcium carbonate ($CaCO_3$) and calcium sulphate ($CaSO_4$), neither of which has injurious effects upon the consumer, but both of which cause hardness and, the former, boiler scale.

Magnesium (Mg). The chief source of magnesium in ground water is dolomite, a carbonate of calcium and magnesium. The sulphate of magnesium ($MgSO_4$) combines with water to form Epsom-salts ($MgSO_4.7H_2O$), and renders the water unwholesome if present in large amounts.

Sodium (Na) is found in all natural waters in various combinations, though its salts constitute only a small part of the total dissolved mineral matter in most waters in humid regions. Sodium salts may be present as a result of pollution by sewage, or of contamination by sea water either directly or by that enclosed in sediments of marine origin. Moderate quantities of these salts have little effect upon the suitability of a water for ordinary uses, but water containing sodium in excess of about 100 parts per million must be used with care in steam boilers to prevent foaming. Waters containing large quantities of sodium salts are injurious to crops and are, therefore, unfit for irrigation. The quantity of sodium salts may be so large as to render a water unfit for nearly all uses.

Potassium (K), like sodium, is derived originally from the alkaline feldspars and micas. It is of minor significance and is sometimes included with sodium in a chemical analysis.

Iron (Fe) is almost invariably present in well waters, but rarely in large amounts. Salts, or compounds, of iron are dissolved from many rocks as well as from iron sulphide deposits with which the ground water comes in contact. It may also be dissolved from well casings, water pipes, and other fixtures in quantities large enough to be objectionable. Upon exposure of the water to the atmosphere, dissolved iron separates as the hydrated oxide that imparts a yellowish brown discoloration. Excessive iron in water causes staining on porcelain or enamelled ware and renders the water unsuitable for laundry purposes. Water is not considered drinkable if the iron content is more than 0.5 parts per million.

Sulphates ($SO_4$). Deposits of gypsum ($CaSO_4.2H_2O$) are the principal source of sulphates dissolved in ground water; soluble sulphates, chiefly of magnesium and sodium, are other sources. Sulphates cause permanent hardness in water and form injurious boiler scale. Sodium and magnesium sulphates are laxative when present in quantities of more than 900 parts per million.

Chloride (Cl) is derived chiefly from organic materials or from marine rocks and sediments. It occurs usually as sodium chloride and less commonly as calcium chloride and magnesium chloride. Sodium chloride is a characteristic constituent of sewage and a locally abnormal amount suggests pollution. However, because chlorides may be derived from many sources, such abnormal quantities should not, in themselves, be taken as positive proof of pollution. Chlorides impart a salty taste to water if they are present in excess of 300 parts per million.

Nitrates ($NO_3$) are of minor importance in the study of ground water. Relatively large quantities in a water may represent

pollution by sewage, or drainage from barnyards, or even from fertilized fields. It is recommended that a bacteriological test be made of water showing an appreciable nitrate content if it is to be used for domestic purposes.

Carbonate ($CO_3$) forms a large percentage of the solid compounds held in solution by the average ground water. The two chief sources are the decomposition of feldspars and the solution of limestone by water carrying carbonic acid in solution, which is the primary agent in rock decomposition. They are indicated in the table of analyses as alkalinity. Calcium and magnesium carbonates cause hardness in water, whereas sodium carbonate causes softness.

Bicarbonate ($HCO_3$). Carbon dioxide dissolved in water renders the insoluble calcium and magnesium carbonates soluble as bicarbonates. Boiling reverses the process by changing the bicarbonates into insoluble carbonates, which form a coating on the sides of cooking utensils.

Total Dissolved Solids (Residue on Evaporation). The term is applied to the residue obtained when a sample of water is evaporated to dryness. Waters are considered high in dissolved mineral solids when they contain more than 500 parts per million, but may be accepted for domestic use up to that point if no better supply is available. Residents, accustomed to the waters, may use waters that carry well over 1,000 parts per million of total dissolved solids without inconvenience, although persons not used to such highly mineralized waters would find them objectionable.

Hardness is a condition imparted to waters chiefly by dissolved calcium and magnesium compounds. It here refers to the soap-destroying power of water, that is, the power of the water

first to use a certain amount of soap to precipitate the above compounds before a lather is produced. The hardness of water in its original state is its total hardness. Permanent hardness remains after the water has been boiled, and is caused by mineral salts that cannot be removed from solution by boiling. It can be reduced by treating the water with natural softeners, such as ammonia or sodium carbonate, or with many manufactured softeners. Temporary hardness can be eliminated by boiling, and is due to the presence of bicarbonates of calcium and magnesium. Waters containing larger quantities of sodium carbonate than of calcium and magnesium compounds are soft, but if the latter compounds are more abundant the water is hard. The following table[1] may be used to indicate the degree of hardness of a water:

Total Hardness

| Parts per million | Character |
|---|---|
| 0-50 | Very soft |
| 50-100 | Moderately soft |
| 100-150 | Slightly hard |
| 150-200 | Moderately hard |
| 200-300 | Hard |
| 300 and over | Very hard |

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1 Thresh, J. C. and Beale, J. F.; The Examination of Waters and Water Supplies, p. 21, London, 1925.

## GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

### GENERAL DISCUSSION

This report is the result of field work done during the season of 1951 except for areas along the Montreal Road and in the vicinity of the community of Cyrville, which were completed during May and June 1952.

The main purposes of the investigation were as follows: (a) as an aid to the Civil Defense authorities of the adjacent city of Ottawa in locating and describing all sources of ground water; (b) to investigate the possibility of overdevelopment of local ground-water supplies in areas where large numbers of housing units were being constructed; (c) to locate new areas where sufficient ground water is available for industries or housing projects requiring substantial amounts of water; (d) to aid individual home owners who are dependent upon ground water for their water supply.

As the quantity and quality of ground water in any one locality is dependent to a large extent upon the material from which it is derived, descriptions of both unconsolidated material and the underlying bedrock throughout Gloucester township are included in the report.

The author was ably assisted in the field by E. R. Sanford, G. R. Murphy, and J. L. Dion during the season of 1951 and by K. F. Pallett, W. R. Wellwood, and R. M. Lavallee during the 1952 field season.

Logs and pertinent data concerning a number of recently drilled wells were supplied through the courtesy of the Ontario Department of Mines.

Reference is frequently made in this report to Rideau Front (R.F.) and Ottawa Front (O.F.). These are land divisions of Gloucester township based upon two surveys; one of which fronts along Rideau River and the other along the Ottawa.

# GEOGRAPHY

## Location and Area

Gloucester township is located in the northeast corner of Carleton county on the south side of Ottawa River immediately east of the junction of Ottawa and Rideau Rivers. The city of Ottawa, a part of which is located in the northwest corner of the township, is 283 miles from Toronto and 126 miles from Montreal. The area of the township subsequent to the annexation of a large part by the city of Ottawa is approximately 110 square miles.

## Topography and Drainage

Gloucester township has, for the most part, a gently sloping or undulating surface, a considerable part being nearly level. The higher ground is generally occupied by glacial till or outwash material and the lower, more level tracts, by marine sand and clay. A number of broad, flat valleys, trending eastward across the central part of the township north of the Russell Road, are important physiographic features. It is believed that these depressions represent former channels of Ottawa River when, in earlier times, its waters were at higher elevations. The most extensive flat areas in the township are in the southeast corner, where the drift consists chiefly of marine clay overlain, in places, by a thin veneer of sand.

The township, as a whole, has a relief of more than 250 feet. The highest elevations are on a drift ridge extending southeast from Bowesville, and on a second ridge that crosses the Metcalfe Road (Queen's Highway 31) about 1½ miles north of the community of South Gloucester. In both these localities elevations of slightly more than 400 feet above sea-level were measured. The lowest part is in the valley of Ottawa River in the northeast section of the township where the elevation is less than 150 feet.

As Gloucester township lies immediately adjacent to the confluence of Ottawa and Rideau Rivers, it is to be expected that these two rivers and their tributaries would carry the run-off for the entire township. The east half of Rideau Front is drained directly by a number of small, intermittent streams into Rideau River and the central and north part of Ottawa Front drains into Ottawa River, chiefly by means of Green Creek, which joins the Ottawa in lot 10, con. 1, O.F., about 1 mile west of Hiawatha Park. The east and southeast part of the township is drained by Bear Brook and tributaries of the north branch of Castor River. These streams flow in a westerly direction into South Nation River, which enters Ottawa River at the community of Wendover, some 32 miles downstream from the city of Ottawa.

## Climate

Gloucester township has a cool, humid climate, tending to be colder than that commonly prevailing in the lowlands region of Ontario adjoining the Great Lakes and the St. Lawrence River[1].

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[1] Hills, G. A., Richards, N. R., and Morwick, F. F.: Soil Survey of Carleton County, Ontario; Ontario Soil Survey, Rept. No. 7, 1944, p. 21.

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The following table shows the monthly precipitation in inches for the last 6 years as well as the total annual precipitation in the Ottawa area. An average precipitation for the last 65 years is also included. It should be noted that, not only has there been a gradual increase in the quantity of precipitation falling upon Gloucester township during the last 6 years, but also the annual totals are, in all instances, larger than the 65-year average total.

During the past years there has been little complaint as to shortage of ground water in the township and it is believed that, owing to the increased precipitation and consequent increased recharge, there will continue to be adequate supplies of ground water for domestic and stock purposes, except in those areas where there is always a shortage because of the lack of a satisfactory aquifer.

PRECIPITATION IN INCHES[1]

| Station | Year | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rockcliffe (Airport) | 1952 | 3.4 | 2.2 | 3.0 | 2.0 | 5.2 | 2.7 | 6.2 | 6.2 | 1.5 | 1.2 | 2.0 | 3.7 | 39.3 |
| | 1951 | 4.7 | 2.2 | 4.2 | 4.3 | 1.9 | 3.3 | 2.2 | 2.4 | 2.6 | 1.6 | 3.8 | 4.8 | 38.0 |
| | 1950 | 3.5 | 2.9 | 3.2 | 2.4 | 1.8 | 3.7 | 6.2 | 4.2 | 1.1 | 1.5 | 3.8 | 3.5 | 37.8 |
| | 1949 | 3.2 | 2.4 | 2.4 | 3.6 | 2.2 | 2.4 | 2.7 | 4.6 | 3.2 | 1.4 | 2.2 | 4.6 | 34.9 |
| | 1948 | 1.7 | - | - | 2.4 | 2.8 | 2.4 | 4.3 | 2.6 | 0.9 | 3.1 | 4.9 | 3.6 | 28.7 |
| | 1947 | 4.6 | 3.9 | 6.2 | 4.0 | 6.2 | 4.0 | 2.8 | 2.0 | 4.7 | 0.8 | 2.4 | 2.1 | 43.7 |
| | average for 65 years (Ottawa)[2] | 2.93 | 2.17 | 2.77 | 2.70 | 2.47 | 3.52 | 3.39 | 2.56 | 3.23 | 2.93 | 2.98 | 2.58 | 34.23 |

1 Extracts from the 'Monthly Weather Map',Meteorological Service, Dominion of Canada.

2 Data from "Climatic Summaries for Selected Meteorological Stations in the Dominion of Canada" Vol. I, Meteorological Division Department of Transport, Canada.

## Population

The population of Gloucester township at the end of 1951 was 5,450 persons, or approximately 50 people per square mile. These figures do not include the inhabitants of the part of the city of Ottawa lying in the township. A large proportion of the population, especially those employed in non-agricultural pursuits, are located adjacent to the Ottawa city limits. There are no incorporated villages and except for Ottawa, Orleans is the largest community. Other smaller communities include Carlsbad Springs, Edwards, Leitrim, Ramsayville, and South Gloucester. Except for a limited number of establishments situated within a short distance of Ottawa and Rideau Rivers, the entire population is dependent upon ground water for their supply of water.

## Transportation

Roads and railroads are plentiful in Gloucester township. Highway No. 17, running parallel with Ottawa River, traverses the north part of the township and joins the cities of Ottawa and Montreal. The River road follows the east bank of Rideau River from the Ottawa city limits to the south boundary of the township, and beyond. These highways as well as a number of township roads form a network of thoroughfares throughout the area. Both the Canadian Pacific and Canadian National Railway lines from Ottawa to Montreal cross Gloucester township near Mer Bleue, and a branch line of the New York Central Railway from Ottawa to Cornwall crosses the central part of the township in a southeast direction. There is also a large, modern airport at Uplands just within the Ottawa city limits, and the Rideau Canal system, which follows Rideau River, is annually utilized by many water craft, chiefly for pleasure.

## Agriculture

The products of the farms in Gloucester township are chiefly those that find a ready market in the adjacent city of Ottawa. The dairy industry is possibly the best developed, but in the north and east parts of the township vegetables are grown on a commercial scale.

## Industry

Building stone is plentiful and there are quarries in many parts of Gloucester township. Some lie along the Montreal Road in the east part of the city of Ottawa and some on MacArthur Road in the south part. All are quarrying limestone of the Ottawa formation.

Sand and gravel is plentiful in Rideau Front, especially in the area adjacent to the Bowesville Road.

Mineral springs in Gloucester township at one time provided quite an industry, but in recent years have fallen off considerably in importance. The most prominent of these is at the community of Carlsbad Springs, which once enjoyed a moderate reputation as a health resort. Waters from Borthwick spring in lot 19, con. IV, O.F. and from Victoria sulphur spring at the side of Green Creek, 2 miles east of Ottawa near Queen's Highway 17, were both at one time used extensively for Medicinal purposes[1].

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[1] Elworth, R. T.: Mineral Springs of Canada; Mines Branch, Bull. 20, pt. II, p. 43 (1918).

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The site of the latter spring was not found during the course of the present survey.

A number of small industries such as cheese making and the manufacture of concrete blocks and wooden articles for construction purposes are operating in various parts of the township.

# GEOLOGY

## Bedrock Formations

Gloucester township is underlain by Palaeozoic rocks of Ordovician age. The following descriptions have been taken from a report by A. E. Wilson[1] published in 1946.

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1 Wilson, A. E.: Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec; Geol. Surv., Canada, Mem. 241, pp. 7-30 (1946).

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Table of Formations

| Era | Period | Sub Epoch | Formations | Thickness (feet) | Lithology |
|---|---|---|---|---|---|
| Palaeozoic | Ordovician | Lorraine | Carlsbad | 500-550 | Grey shale and sandy, rusty shales with thin dolomitic layers near top |
| | | Gloucester | Billings | 260-300 | Black shale with a few feet of brown shale at base |
| | | Collingwood | Eastview | up to 20 | Limestone with a little interbedded shale |
| | | Disconformity | | | |
| | | Trenton and Black River | Ottawa | 690-700 | Limestone, with a little shale and some sand at its base |
| | | Disconformity | | | |
| | | Chazy | St. Martin<br>Rockcliffe | 20-155<br>150-165 | Impure limestone<br>Shale with sandstone lenses |
| | | Disconformity | | | |
| | | Beekmantown | Oxford | 240± | Dolomite with a little shale at the top |
| | | | March | 30+ | Interbedded sandstone and dolomite |
| | Ordovician or Cambrian | | Nepean | up to 500 | Sandstone |
| Great unconformity | | | | | |
| Precambrian (archaean)? | | | Grenville | | Crystalline limestone, quartzites, and metamorphic rocks; associated granite and granite-gneiss |

## Precambrian

Little information has been obtained concerning the rocks of the Precambrian complex, which underlies the Palaeozoic sedimentary formations throughout Gloucester township. They do not outcrop in the township, and so far as is known only one well has penetrated them. This well, located in lot 8, Gore, R.F., was reported to have encountered the Precambrian at 460 feet. However, no description of these rocks exists. The Precambrian rocks, where they are exposed in places adjacent to the township, consist of crystalline limestone, gneiss, and quartzite intruded, deformed, and metamorphosed by bodies of granite, syenite, and other igneous rocks.

## Ordovician

Nepean Formation. The Nepean formation directly overlies the unevenly eroded Precambrian floor and is in turn overlaid by the interbedded sandy dolomite and sandstone of the March formation. The Nepean is, in general, a cream-coloured sandstone, weathering grey and mottled with irregular rust spots. It is made up of a coarse quartz sand, and on analysis has been found to contain an average of 99.31 per cent silica. Numerous outcrops indicate that the Nepean formation underlies the drift along a belt approximately 4 miles long and up to ½ mile wide with a southeast trend across concessions V and VI, R.F. in the south part of Gloucester township. This belt is bounded on the northeast by the Gloucester fault.

March Formation. The March formation lies above the Nepean sandstone and below the Oxford formation. It consists of alternating grey sandstone, and sandy dolomite or blue-grey dolomite, all weathering dark rusty brown. The sand grains are large, generally rounded and commonly loosely cemented. Rocks identified as March directly underlie the drift in a narrow belt on the southwest side of the belt of Nepean rocks described above. A second belt cuts across lots 21 to 23, cons. I and II, R.F.

Oxford Formation. The Oxford formation lies above the March and is succeeded by the Rockcliffe. It consists chiefly of a thick-bedded, rusty weathering dolomite, which here and there changes laterally to a limestone. The formation is generally considered to be early Beekmantown in age. Some 45 square miles of drift in Gloucester township is underlaid directly by the Oxford. The largest area occurs in the southwest corner of the township, where rocks of the Oxford formation extend along Rideau River from Black Rapids south to Manotick and along the south boundary from Manotick east to a point 2 miles beyond the community of South Gloucester. The third side of this triangular-shaped area is bounded by the Gloucester fault. A much smaller area lies along the south side of Ottawa River from the Ottawa city limits east to Orleans.

Rockcliffe Formation. In Gloucester township, the Rockcliffe formation overlies the Oxford and in turn is overlain by the St. Martin. These rocks are composed of friable shales with lenses of sandstone. The former is, for the most part, light olive-green with a few pockets of iridescent shale. The sandstone normally is fine grained and grey. Two areas within Gloucester township are underlain directly by the Rockcliffe formation. One narrow belt of these rocks extends from the Ottawa city limits east to Orleans; a second and much smaller belt occurs in lots 6 and 7, cons. Gore and III, R.F.

St. Martin Formation. The St. Martin formation lies conformably above the Rockcliffe and unconformably beneath the Ottawa limestone. It consists predominantly of limestone with some shaly or dolomitic limestone members towards the base. The only area of the St. Martin formation that directly underlies the drift in Gloucester township is a narrow belt extending from the Ottawa city limits east to the community of Orleans. It lies south of the belt of Rockcliffe formation previously described. The St. Martin and Rockcliffe are both considered to be Chazy in age.

Ottawa Formation. The Ottawa formation comprises those beds commonly called Black River and Trenton, including the Pamelia, Lowville, and Leray members of the former and the Rockland, Hull, Sherman Fall, and Cobourg members of the latter. The formation is dominantly limestone, but includes some shale and small quantities of sandstone at the base. The Ottawa formation underlies a roughly triangular-shaped area some 9 square miles in extent in the north-east part of the township.

Eastview Formation. The Eastview is a thin formation that overlies the Ottawa limestone and is overlain by the Billings. It is composed of dark grey, fine-grained limestone interbedded with shale. The dark, friable, shaly members of the formation are more common toward the top. The formation occurs only in the vicinity of Green Creek, in parts of lots 17, 18, and 19, cons. I and II, O.F.

Billings Formation. The Billings formation lies above the Eastview formation and below the grey shales of the Carlsbad. Except for a few feet of brown weathered shale in the lower part, the formation consists entirely of thick beds of black, fissile shale. It is not a widespread formation, exposures forming a somewhat horseshoe-shaped area in the western part of Gloucester township. One arm of this area crosses the north part of the township in a westerly direction from the east boundary of the township to the Ottawa city limits. The tip of the other arm extends into lots 6 to 9, con. III, R.F.

Carlsbad Formation. The Carlsbad formation is the uppermost of the bedrock formations underlying Gloucester township. The rocks consist predominantly of grey shale with some impure limestone or dolomitic bands and a little sand. It directly underlies the drift in some 54 square miles of Gloucester township, and is the largest area underlaid by one bedrock formation in the township.

## Overburden

The Pleistocene geology of the greater part of Gloucester township was described by Johnston[1] in 1915. The mapping was completed by the author during the summer of 1951. The following description of the drift was taken principally from Johnston's memoir, supplemented by information gained by the author's own observations in the field.

[1] Johnston, W. A.: Pleistocene and Recent Deposits in the Vicinity of Ottawa, with a Description of the Soils; Geol. Surv., Canada, Mem. 101, pp. 11-36 (1915).

### Pleistocene

Glacial Till. Glacial till is the unstratified, non-fossiliferous material laid down by the last ice-sheet over much of Gloucester township. Most of the till is spread over the township as undulating ground moraine. A few of the larger undulations that project through the overlying marine sand and clay in the southwest part of the township appear to be small, drumlinoid structures.

The character and composition of the till are largely determined by the nature of the bedrock upon which, or near which, it lies. However, there is a larger proportion of boulders and fragments of Precambrian rocks in the till in the northern part of the township than in the southern, for that part is adjacent to the areas of Precambrian rocks lying north of Ottawa River. The greater part of the material, especially the fine-grained part, is derived from local rocks.

Although the till is without stratification, in places it contains lenticular layers of irregularly shaped masses of stratified sand or silt, which may represent frozen masses of stratified material ploughed up by the glacier and incorporated in the till.

Fluvioglacial Sand and Gravel. Stratified sand and gravel of fluvioglacial origin are of local and irregular occurrence in Gloucester township. They rarely outcrop at the surface,

generally being buried beneath a covering of marine sand and clay. The largest areas in which these materials are known to occur on the surface are in the northwest part of the township, where they extend southeast from the Ottawa city limits for a distance of some 4 miles along the Bowesville Road. The material, as revealed in a number of pits, varies from a sand, grey in colour and markedly crossbedded, to a poorly sorted, coarse, bouldery gravel. A number of wells drilled through the overlying marine sand and clay in search of a supply of potable ground water, have encountered gravel beds of various thicknesses beneath the clay, most of which lie directly on bedrock. This is especially true in the vicinity of Ramsayville and south of that community along the Base Line Road, which separates Rideau Front from Ottawa Front. It is known locally as 'black gravel' because of the high content of dark-coloured shale from the Billings and Carlsbad formations. It has been described by a local driller as consisting predominantly of fragments of greyish shale with smaller amounts of more rounded pebbles of crystalline rocks. The individual beds of 'black gravel' do not appear to extend over any great distance. Wells drilled close to wells that were reported to have encountered gravel did not intersect any. Gravel consisting predominantly of pebbles and boulders of limestone and crystalline rocks was reported to occur between the overlying marine clay and bedrock in the south parts of concessions B.F. and I. These gravels are in the same stratigraphic position as the 'black gravels' and are also considered to be fluvioglacial in origin.

Marine (Champlain) clay, silt, and sand. After the retreat of the ice-sheet from the Ottawa Valley, the area was enundated by an arm of the sea, known as the Champlain Sea. The drift laid down in Gloucester township as a result of this marine invasion consists of fine sand, silt, and clay in the low-lying areas and coarser sand and gravel as beach deposits in the higher areas.

The Champlain, or Leda clays as they are sometimes called, cover much of Gloucester township. Their colour is, for the most part, bluish grey changing to brownish red in the upper, weathered part where they are exposed. The upper part of the formation differs markedly in physical character from the lower. The lower part is a sandy or silty clay, generally well laminated, especially toward the base, whereas the upper is more massive and the bedding is indistinct.

Most of the areas in which the clays outcrop are extremely flat, but in the east part of the township this original surface of deposition has been partly destroyed by stream erosion and terracing.

The thickness of the clay varies considerably across the township. An examination of the drillers logs of a number of water wells in Gloucester township given on page 109 indicate its thickness in several places.

The marine or Champlain sand is somewhat irregular in its distribution and is generally of no great thickness, varying from a few inches to a few feet. In some areas it forms a thin veneer over both glacial till and bedrock. An exception is in lot 9 con. II, R.F., in the Bowesville area where the sand has been reported in two different localities to be at least 70 feet deep. It varies in character from very fine to coarse sand. Gravel is here and there associated with the coarser material. Most of the sand is somewhat oxidized and yellow in colour. The finest sand generally occurs in horizontal beds in the nearly level areas where it overlies marine clay.

The beach deposits of sand and gravel formed along the shorelines of the Champlain Sea are not extensive but are of local importance as they yield good quality concrete aggregate.

## Recent

Alluvium or flood-plain material deposited by present streams occurs along Ottawa and Rideau Rivers as well as along some of their smaller tributaries. In the latter case the beds are of such small extent that it is not possible to show them on the geological map that accompanies this report. The islands in Ottawa River downstream from the mouth of Gatineau River are composed largely of alluvium. The material consists mainly of very fine sand containing considerable organic material and underlain in places by gravel. The sand is generally yellowish or reddish and is well leached and oxidized so that it contains little calcareous material. In places the beds have a thickness of 10 to 15 feet but in general the thickness is only from 6 to 10 feet.

Dune sand occurs chiefly in the north parts of cons. III and IV, Rideau Front, where it overlies sand and gravel of fluvioglacial origin, from which it was in part derived. Smaller, isolated dune areas occur in other parts of the township. They are commonly associated with, and adjacent to, exposures of marine sands or material of fluvioglacial origin.

Deposits of peat, consisting of partly decomposed organic material, occur over comparatively large parts of the township. The largest deposit is known as the Mer Bleue bog. This bog, which contains the largest supply of fuel peat in the district, was described by Nystrom and Anrep[1] in 1909.

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[1] Nystrom, E., and Anrep, A.: Investigation of the Peat Bogs and Peat Industry of Canada, During the Season 1908-9; Mines Branch, Canada, Bull. No. 1, 1909.

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## WATER SUPPLY

Gloucester township appears to be fairly well supplied with adequate quantities of ground water for both domestic and stock purposes except in a few localities. Supplies of ground water were reported as being unsatisfactory in the flat areas underlain by

marine sediments in the southeast part of the township. In this area are the communities of Piperville and Edwards. The drift there consists predominantly of thick beds of relatively impervious marine clay overlain, in part, by thin beds of marine sand. In some parts of the township, moreover, the ground water is unsatisfactory for consumption by both humans and animals. A number of wells, for instance, dug in marine clay or drilled to the 'black gravel' beds underlying the clay, are reported to yield only highly mineralized water. The Carlsbad and Billings formations, which underlie a large part of Gloucester township, are reported, in many instances, to yield water too high in saline content to be used for domestic or stock purposes.

About 65 per cent of the wells in Gloucester township are of the dug type, and 14 per cent are drilled. The remainder consist of bored wells, sand points, and diamond drill-holes. Approximately 74 per cent are obtaining their water from depths of 40 feet or less. About 92 per cent of the wells have a permanent water supply sufficient for the present demands made upon them and 6 per cent constitute wells that go dry intermittently. In describing the principal beds that yield water to the wells, the statements of owners and drillers as to the character of the aquifer were necessarily accepted.

To facilitate the use of this report as a reference the ground-water conditions in Gloucester township are described systematically along, and adjacent to, the major concession roads, which form a complete network across the township, and also along a number of the better-known roads that radiate out across the township, chiefly from the limits of the city of Ottawa.

## RIVER ROAD (MANOTICK ROAD)

The River Road is that paved highway that extends along the east bank of Rideau River from the limits of the city of Ottawa to the south boundary of the township. It is nowhere a greater distance

than four-tenths of a mile from the river. It is entirely in that part of Gloucester township known as Rideau Front and crosses con. I at the north and con. B.F. at the south.

Bedrock in the area adjacent to the River Road consists entirely of the Oxford formation, except in lot 19, con. B.F., where the March formation has been brought to the bedrock surface on the north side of a large fault. Unconsolidated material exposed on the surface consists chiefly of marine clay covered by a veneer of sand. Some areas of glacial till, however, occur locally along the southern part of the road in lots 29 and 30, con. B.F. The till generally occurs as low, somewhat irregularly shaped hills or knolls with a general trend of south 10 to 20 degrees west. This is also the direction in which the last ice-sheet moved across the township and suggests that the till knolls are the tops of drumlinoid structures, partly buried by later deposits of marine sediments. The drift on Long Island consists of knobs and ridges of glacial till surrounded by level tracts of marine sand and clay.

The first well along the River Road immediately south of the Ottawa city limits is a diamond drill-hole sunk at a private residence in lot 19, con. I. The hole was reported to be 75 feet deep with bedrock encountered at 62 feet. Bedrock along this particular part of the River Road was formerly mapped as Oxford limestone and dolomite but grey shales believed to belong to the Rockcliffe formation were reported in the diamond drill-hole.

A number of cottages lie along the east bank of the Rideau River in lot 10, con. I. They are built on a narrow, flat plain at the foot of a steep bluff formed by Rideau River when it was at a higher elevation. The water supply for these cottages is derived both from the river and from shallow wells dug in what appears to be sandy alluvium overlying marine clay. The intake area for these wells is probably the general area above the east of the bluff. In any case the proximity of Rideau River would ensure a satisfactory supply of ground water for most dug wells in this area. If, in times of

drought, a decrease in the quantity of ground water percolating down from the intake area should lower the water-table, Rideau River would change from an effluent stream to an influent and supply water to the wells. The water-table would thus be stabilized at a point possibly no more than a foot or two below the level of the water in the river. Any well that goes dry could thus be assured of water by being deepened.

In lots 9 to 12, con. I, considerable quantities of ground water were reported to occur in sand beds beneath the clay and lying immediately upon bedrock. These beds are probably of fluvioglacial origin and related to the large areas of similar material exposed a few miles to the east and northeast. The latter, no doubt, constitutes the intake area for the large quantities of ground water yielded by wells drilled through the clay, both in lots 9 to 12 and farther south along the road. The water in the sand is under considerable pressure and some difficulty was experienced while drilling in preventing the sand from rising in the casing. Sand will also enter the wells when the water levels are low following a period of heavy pumping. To overcome this some drillers have driven the casing tightly into the rock. This prevents not only the sand but also its water from entering the well and the well, consequently, depends on ground water derived from bedrock.

Two flowing wells, drilled in lot 13, con. I, R.F., at cottages along Rideau River, derive their supply of ground water from beds of sand and gravel beneath the marine clay, apparently the same beds encountered in the wells drilled in lots 9 and 10, con. I. The surface of the ground at the flowing-artesian wells is considerably lower than the latter and there is apparently sufficient hydrostatic head to create flowing-artesian conditions in this particular area.

Wells drilled at three cottages along Rideau River in lot 15, con. I, all encountered ground water under considerable pressure. In two of the wells bedrock was reported to have been penetrated to

depths of from 20 to 30 feet. When these wells were visited in July 1951, one well was flowing at a rate of approximately 100 g.p.h. with the piezometric surface about 1 foot above the level of the surrounding ground. The chief source of the water is apparently sand beds similarly situated to those described above.

One well situated on the west side of the River Road, in lot 17, con. B.F., was bored 25 feet into marine clay and lined with small diameter concrete tile. This well is continually being pumped dry. It is believed that the reservoir capacity of this well is too small considering the type of material from which the ground water is being derived. It has been found that wells in marine clay, through which water percolates slowly, should have diameters of 36 to 42 inches to supply quantities of water sufficient for normal domestic use.

Some wells located in lots 18 and 19, con. I, encountered ground water under considerable pressure in gravel beds beneath marine clay and overlying bedrock. The water was reported to be medium hard and to have a faint odour of hydrogen sulphide gas. One well in lot 19 was drilled to a depth of 90 feet with bedrock, consisting of the March formation, encountered at 76 feet. No gravel was reported to have been encountered in this well, the water being derived directly from bedrock. The absence of sand and gravel in this well suggests that the beds so extensive along the north part of the River Road may be less continuous toward the south. The same thing is suggested by the fact that surface exposures of fluvioglacial materials apparently die out in the south part of the area. If this is so, some of the wells drilled along the south part of the River Road will not encounter these favourable beds.

In lots 21 to 23, con. B.F., the beds of marine clay, which occur on or very near the surface, are reported to be approximately 30 feet thick. Wells dug or drilled through the clay have encountered irregular beds of gravel containing considerable quantities of ground

water. The thickness of the clay beds in this area is not too great to prevent well owners from digging through it and obtaining an excellent supply of ground water without the expense of drilling a well.

Wells drilled along the River Road from lots 26 to 30, con. B.F., obtain their water both from gravel and the underlying Oxford formation. The thickness of the drift varies from 20 to 46 feet. Gravel beds were reported from almost all the drilled wells, but contained only limited amounts of ground water. They are described as irregular and of various thicknesses. The chief source of ground water is, consequently, the Oxford formation, which yields supplies of ground water sufficient for all normal domestic and stock purposes.

It is apparent, to summarize the foregoing, that the principal aquifers yielding ground water to wells along the River Road consist of extensive but irregular beds of fluvioglacial sand and gravel underlying marine clay and directly overlying bedrock. The water yielded by these beds is under considerable hydrostatic pressure. It is medium hard and in some wells emits a faint odour of hydrogen sulphide gas. Hard, clear ground water can be obtained from the underlying Oxford and March formations.

The marine sand and clay, which covers most of the surface of the ground along the entire length of the road, is not a good source of ground water. Some of the wells belonging to farmers along the River Road, which are reported drilled, were originally dug wells deriving their ground water from marine clay. The quantity of water was reported to have been gradually diminishing, both because of increased consumption and because of a gradual lowering of the water-table. Such wells were deepened by drilling to assure a more adequate ground-water supply.

ROAD BETWEEN CONCESSIONS B.F. AND I (R.F.)

Information was gathered on only fifteen water wells along this road, which is about 2½ miles long. The drift is similar to that along the River Road. It consists of level tracts of marine

sand and clay interspersed at the south end with low rounded hills of glacial till. Bedrock directly underlying the drift consists entirely of the Oxford formation. There is apparently a low ridge in the bedrock surface that trends easterly from lot 22, con. I (R.F.). At the west end of this ridge bedrock is reported to be only 16 feet from the surface and it outcrops about a mile to the east. Farther south along the road, the thickness of the overburden gradually increases to 40 feet in lot 29, con. I (R.F.). Ground-water conditions are similar to those along the River Road and need no further description here.

ROAD BETWEEN CONCESSIONS I AND II (R.F.)

This road branches off the River Road in lot 9 and extends in a southeasterly direction straight to the south boundary of Gloucester township. Bedrock directly underlying the drift consists of the Oxford formation except that in lots 22 and 23 rocks of the March formation are carried up along the north side of a large fault. The Oxford formation outcrops along the road in lots 24 and 25 where there is an easterly trending ridge on the bedrock surface. About a mile south of this a second rock ridge with a similar trend is indicated by the elevations reported of bedrock surface in drilled wells in lot 27, con. I (R.F.).

The unconsolidated material exposed on the surface in lots 22 and 23 along the road north of the outcrop area consists of marine sand and clay. In the outcrop area and south of it for about a mile, the drift is glacial till. Marine sediments again appear on the surface at the extreme south end of the road.

Information was gathered on only two wells along the road between lots 9 and 17. The northernmost well, in lot 11, con. II (R.F.), is a drilled well 65 feet deep, and is reported to yield large quantities of hard, clear water. If bedrock was encountered its depth is unknown. The second well, in lot 15, con II (R.F.), and dug 19 feet in marine clay, was reported to yield small quantities of water, sufficient for domestic use.

The most satisfactory supplies of ground water along this road are derived from bedrock. Unlike the River Road, no sand or gravel was reported beneath the marine sediments and, consequently, drilled wells have penetrated bedrock in the search for adequate ground-water supplies. No instance was recorded of a well drilled into bedrock failing to obtain sufficient quantities of potable ground water for normal domestic and farm needs. Three wells in lots 22 and 23 were reported to be obtaining excellent supplies of ground water from the March formation. The water here is under considerable hydrostatic pressure, so much so that a drilled well 45 feet deep, in lot 23, con. II (R.F.), flows during the greater part of the year. These exceptional pressures are probably the result of local bedrock conditions. The large fault in bedrock in this area, along which the March formation was uplifted, is apparently relatively impervious to the passage of ground water. Ground water percolating through the sandy beds of the March formation, therefore, tends to accumulate against the fault and to form a ready source of ground water under considerable pressure. It should be noted, however, that the sandy beds that constitute the major aquifers in the March formation are not continuous and ground water under sufficient pressure to reach the surface will not be found everywhere.

Wells dug in marine clay have not proved satisfactory. Wells dug in this material down to bedrock obtained a limited supply of ground water at the contact but in most cases it was necessary to drill a considerable distance into the bedrock from the bottom of the dug part of the well to obtain sufficient water.

The glacial till exposed along the south part of the road is reported to be a more satisfactory source of ground water than the marine clay. Wells dug in this material are yielding sufficient quantities of ground water for all normal farm use. Because the till contains more sand than the marine clay it is more permeable and yields a larger supply of ground water to a well.

BOWESVILLE ROAD

The part of the Bowesville Road considered here runs from the Ottawa city limits in lot 9, con. II (R.F.), southerly across cons. II and Gore (R.F.), crosses the Canadian Pacific Railway about 2 miles northwest of Gloucester station, and then follows the road between Gore and Con. III (R.F.), to the south boundary of Gloucester township. The area about Gloucester Station is also discussed.

Bedrock directly underlying the drift along this road consists entirely of rocks of the Oxford formation. Outcrops that occur in lot 26 in the vicinity of the Canadian Pacific Railway crossing evidently are the eastward extension of the rock ridge in lots 23 and 24 about 2½ miles to the west, mentioned previously. Four wells were reported to have penetrated bedrock. Two of these, located in the outcrop area in lot 26, are 20 and 49 feet deep respectively, and the other two, in lot 30, con. III (R.F.), are 86 and 127 feet deep. A deep valley in the bedrock surface appears to exist between lots 26 and 30.

The unconsolidated material exposed on the surface along the north part of the Bowesville Road consists of fluvioglacial sand and gravel. In lots 15 and 16 there is a considerable amount of dune sand. Except in the vicinity of the outcrops of Oxford formation in lots 25 and 26, where the drift is a sandy type of till, the unconsolidated material along the part of the road separating Gore and con. III (R.F.), consists of irregular beds of marine sand overlying clay.

At the time the ground-water survey was conducted, it was found that the water-table was very low along the north part of the road between lots 9 and 15. There, the depth of eleven wells dug in fluvio-glacial sand and gravel ranges from 18 to 70 feet with an average of 55.5 feet, and the depth to the water surface in them varied from 37 to 68 feet with an average of 48.5 feet. One of the few

dry wells in Gloucester township is in lot 13, Gore (R.F.), where a dug well 45 feet deep failed to encounter ground water.

The altitude of the area in which these wells occur is considerably greater than that of much of the surrounding country, being in some parts more than 375 feet above sea-level. In Edwardsburgh township, Grenville county, where fluvioglacial material exists at comparable elevations, the water-table was also found to be much deeper than in the surrounding, lower areas.

It is interesting to note that only one sand-point well was reported in the area. This is a well 45 feet deep in lot 5, Gore (R.F.). Two reasons have been given to explain this; (1) the extreme fineness of some of the sand, which causes trouble by entering the well; and (2) the great depth to which the sand point must be driven to obtain a satisfactory supply of ground water.

No wells were reported between lots 18 and 24. The unconsolidated material there consists of thin beds of marine sand overlying clay and it is doubtful if they contain aquifers from which large quantities of ground water could be obtained. The depth to bedrock is not known in this area, but is assumed to be great.

In the vicinity of Gloucester Station, the depth of a number of water wells varies from 19 to 40 feet. These wells are all dug into the marine sand, a few of the deeper penetrating the underlying clay. All wells are non-artesian, that is, they obtain their supply of ground water from the zone of saturation below the water-table. The water is reported to be fairly hard but to be of sufficient quantity for all normal farm use.

Wells dug in that area mapped as sandy till are reported to be yielding a plentiful supply of ground water, but along the extreme south part of the road the marine sand beds are thin and wells have been dug into the underlying clay in an attempt to obtain a sufficient supply. This clay is exceptionally massive and interbedded sandy layers that might yield fair amounts of ground water are scarce.

ROAD BETWEEN CONCESSIONS III AND IV (RIDEAU FRONT)

This road runs southeast from the Ottawa city limits at the junction of the Metcalfe Road and the Hunt Club Road, through the community of Johnston Corners, to the south boundary of the township.

The Oxford formation directly underlies the drift along the entire length of the road except for 1 mile at its extreme north end where the shaly rocks of the Billings and Carlsbad formations have been brought to the surface by the Gloucester fault, a major structural feature of the underlying bedrock formations.

Little is known concerning the depth to bedrock along this road. Bedrock was reported 14 feet from surface in lot 9, con. III (R.F.), at the point where the upward projection of the Gloucester fault crosses the road, and at 20 feet in lot 15, con. IV (R.F.). The presence of a small but fairly deep valley in the bedrock surface is indicated at Johnston Corners. The school well in this community was drilled to a depth of 125 feet without encountering bedrock, although a well in lot 26, con. III (R.F.), about ¼ mile west of Johnston Corners, was reported to have encountered bedrock at 10 feet.

Marine sand is the principal material exposed at the surface and also lies beneath the large swamps in lots 11 to 14 and 19 to 21. The depth and extent of these sands have rendered much of the land in the area unsuitable for farming. A number of sand dunes, the material for which was derived from the marine sand, occur in lot 9, con. III (R.F.). Farther south along the road, in lots 22 and 23, there is an irregular area of fluvioglacial sand and gravel. There is also a small area of glacial till in lot 7 along the north part of the road.

Many houses have been built recently along the extreme north end of the road near the Metcalfe Road. These homes are

entirely dependent upon ground water for their water supply. In most instances, the wells that supply the necessary water are of the the dug type. They have all been reported as yielding sufficient quantities of ground water for normal domestic consumption. Some of the dug wells are extremely shallow (5 to 8 feet in depth) and have been described as 'springs' by the owners. Ground water seeping rapidly into the well from porous, saturated sand gives this effect. No information was obtained as to the thickness of the sand or of the type of material immediately beneath it, but if it is thin and underlain by clayey material or compact till the ground water at present being obtained may be perched and the supply not dependable. A perched water-table would form because precipitation falling upon sandy material sinks in rapidly and percolates downward until this movement is slowed down by the more impervious clay or till beneath to such an extent that the sand immediately above becomes saturated with water.

As the intake area for the ground water is local, it is inadvisable to construct storm sewers along the road where wells serve as the source of water supply. Storm sewers would tend to drain off much of the precipitation that would otherwise reach the water-table, which would be lowered as a result and the shallower wells fail.

The shaly bedrock formations that directly underlie the drift along the road north of the Gloucester fault are a poor source of potable ground water. One well in lot 6, con. III (R.F.), was drilled into bedrock to a total depth of 300 feet. It was reported to have yielded considerable quantities of ground water, but the hydrogen sulphide gas content of the water was so high that it was unfit for domestic consumption. It is thought that the hydrogen sulphide gas came from rocks in either the lower part of the Carlsbad formation or the Billings, both of which were penetrated by the lower

part of the well. It was, accordingly, decided to cement the well off at a depth of 150 feet. The yield was not appreciably decreased and after considerable pumping the ground water was found to be sufficiently free of hydrogen sulphide gas to be satisfactory for domestic purposes.

Farther south along the road in lot 8, con. III (R.F.), two wells drilled into bedrock to depths of 129 and 131 feet, respectively, were reported to yield large quantities of ground water with only a faint odour of hydrogen sulphide gas.

The most northerly drilled well along the road south of the Gloucester fault is located at the Aladdin Drive-in Theatre in lot 10, con. III (R.F.). It was drilled to a depth of 115 feet and was reported to enter the Oxford formation at 95 feet. The water, which is under considerable hydrostatic pressure, is reported to come chiefly from gravel beds 15 feet thick immediately above the bedrock. A second drilled well, in lot 15, con. IV (R.F.), is a diamond drill-hole 50 feet deep, the last 30 of which is in bedrock. Despite the small reservoir capacity of this well, the supply of ground water was reported to be sufficient with the water level remaining fairly constant at 25 feet from surface. The occurrence of a well of this type must mean that there are aquifers in some beds of the Oxford formation capable of yielding considerable quantities of ground water to a pumping well. Such aquifers may lie along bedding planes but in this well it seems more likely to be open fractures along joint planes extending down from the bedrock surface and along which ground water can pass freely.

There is little information about the water supply of the small housing development in lot 16, con. III (R.F.), between the road and the Canadian Pacific Railway, along what is sometimes known as Pine Road. One household was reported to obtain a satisfactory

supply of fairly soft ground water from a sand point driven approximately 10 feet into marine sand, the only material exposed in the area. It is believed that other homes in the vicinity derive their ground-water supply in a like manner. A deeper drilled well is reported to exist in the area but, if so, no information was obtained regarding it.

No water wells are known along the road from lots 17 to 21 inclusive. The overburden here consists of marine sand with large areas of swamp. The area is one of limited agricultural possibilities.

There appears to be no shortage of ground water in the area about Johnston Corners. The drift, consisting of both fluvioglacial and marine material, is yielding excellent supplies of ground water to a number of dug wells, and drilled wells are reported to be deriving plenty of ground water from the underlying Oxford formation. One well, in lot 24, con. III (R.F.), drilled 42 feet to bedrock, was reported to obtain considerable supplies of ground water from a zone immediately above bedrock and it is possible that much of the ground water obtained from wells drilled in this area is coming from this zone. No water wells drilled in this area is coming from this zone. No water wells were reported along the road between lots 28 and 30, at the south boundary of the township.

METCALFE ROAD (QUEEN'S HIGHWAY 31)

The Metcalfe Road or Queen's Highway No. 31 is the paved road that connects the city of Ottawa with the town of Morrisburg on the St. Lawrence River, approximately 48 miles to the south. In Gloucester township it runs southeasterly from the Ottawa city limits, in lot 6, con. IV (R.F.), across concession IV to a point about $\frac{1}{2}$ mile north of the community of Leitrim. From there it runs along the concession line, through the communities of Leitrim and South Gloucester, to the south boundary of the township.

Bedrock directly underlying the drift along the part of the Metcalfe Road in Gloucester township consists of the Oxford and Carlsbad formations. The Carlsbad underlies that part of the road north of a point about $\frac{1}{2}$ mile south of the community of Leitrim, the rest being underlain by the Oxford formation. The drift is thin in many places from Leitrim south to the township boundary and there are numerous outcrops of bedrock. About half a mile north of Leitrim the drift begins to thicken rapidly, indicating the presence of a wide, shallow valley in the bedrock. Information received from a number of well owners would indicate that this valley is filled with glacial outwash material and extends from some distance north and east across the region. The west limit of the valley is probably the Gloucester fault, along which an irregular scarp apparently occurs. An examination of the elevations of bedrock in the area immediately north of Leitrim indicates that the bedrock surface drops off at least 100 feet within a distance of $\frac{1}{2}$ mile. More work, chiefly inside the limits of the city of Ottawa, will be necessary before the width and length of the valley can be determined. The greater part of the drift exposed along the central and southern parts of the road, in the areas where bedrock is relatively close to surface, is glacial till. Overlying this till are small scattered areas of marine sand and clay too small to show on the Pleistocene map. North of this, along that part of the road that extends diagonally across concession IV (R.F.), the drift consists of fluvioglacial sand and gravel, overlain in part by beds of sand and gravel laid in the Champlain Sea.

In recent years, a considerable number of new homes have been built along the north end of the Metcalfe Road in Gloucester township. The occupants of these houses are entirely dependent upon ground water for their water supply. In lot 6, con. IV (R.F.), there are two drilled wells. Both wells, one of which is 85 feet deep, are reported to be

deriving abundant ground water from beds of fluvioglacial sand and gravel beneath considerable thicknesses of marine clay. Farther south, in lot 8, drilled wells are reported to be obtaining their supply of ground water from a similar source. Here the aquifer is described as a coarse, black gravel underlying a finer, grey sand. Both materials contain plenty of ground water under pressure, and difficulty has been experienced during drilling in preventing the sand from entering the casing before the well is completed. In the most satisfactory drilled wells in this area the casing has been driven through the sand into the coarse gravel.

Owners of drilled wells that derive ground water from sand report that the sand enters at the bottom of the casing when the water level is lowered by excessive pumping. This is to be expected because it is mainly the pressure of the column of water inside the casing that prevents the sand from entering the well. Accordingly, when the height of the column is shortened the pressure on the sand in the bottom of the well is lessened, allowing it to rise into the well.

Many of the sand points and dug wells along the road between lots 6 and 11, con. IV (R.F.), are relatively shallow. The depths vary from 6 to 35 feet with an average of 21 feet. Many of the dug wells are lined with 30-and 36-inch concrete tile. These shallow wells are believed to obtain their supplies of ground water from the zone of saturation below the water-table, and, consequently, have been classified as non-artesian. As there is only 2 to 5 feet of water standing in these wells the sandy material in which they are dug must yield its water readily to pumping wells. Because of the abundance of ground water available at shallow depths, drilling for water should be unnecessary in this area.

It has been found that the more potable ground water along that part of the Metcalfe Road in lots 11 to 17, immediately north of the community of Leitrim, is recovered from till immediately above

bedrock by shallow, dug wells. The minimum depth of the better wells in this area is 14 feet. There is apparently plenty of ground water in the underlying Carlsbad formation but it contains too much hydrogen sulphide gas to be satisfactory for domestic use. Wells drilled into bedrock in the vicinity of Leitrim are reported to yield water that is unsatisfactory for this reason, and also because of the presence of particles of clay so fine that they are difficult to filter out by ordinary methods.

These characteristics are common in ground water from the Carlsbad shale and cannot be corrected without undue expense. It was was reported, for instance, that there was no decrease in the cloudiness of the water after it had been filtered through 6 feet of fine sand.

The upward projection of the Gloucester fault crosses the road in lot 17 about $\frac{1}{2}$ mile south of the community of Leitrim. South of this point bedrock is near the surface and as a result, between lots 19 and 27, a relatively large number of wells are drilled into the Oxford formation, which underlies the drift along this part of the road. The ground water obtained from the Oxford in this area is described as hard and clear and to be under some hydrostatic pressure. Few wells dug in the overlying till, chiefly to bedrock, are reported to yield sufficient supplies of potable ground water.

Conditions are similar in the area about the community of South Gloucester, where information was obtained on several shallow wells dug in the till and some deeper ones drilled into the Oxford. Most of these wells, which supply water for both domestic and stock purposes, are reported to yield all the water required. Some of the wells were reported to be pumping considerable sand although the casing was supposed to be driven tightly into the rock. If so, it is probable that some parts of the surface of the underlying Oxford formation may be badly fractured. Sand may enter a well through any

fracture immediately below the bottom of the casing. Numerous irregular fractures in the bedrock surface, especially in areas where the drift is thin, may preclude the accumulation of a satisfactory supply of ground water. Such fractures may penetrate deep into bedrock and give ready passage to surface water or water contaminated by nearby septic tanks. In the South Gloucester area, this danger is not great because septic tanks are few and widely separated. Elsewhere in more built up areas this condition may constitute a real threat to the health of the inhabitants. The danger may be avoided if the casing is driven into bedrock deeper than the deepest of the large fractures and thoroughly cemented. The source of the water for the small springs in South Gloucester that appear to issue from the till is thought to be the underlying bedrock, the intake area being the high ground about 1 mile to the north.

ROAD BETWEEN CONCESSIONS V AND VI (RIDEAU FRONT), (HAWTHORNE ROAD)

The Hawthorne Road runs southeasterly straight across the central part of the township from the Ottawa city limits to its south boundary. There is a gap in lots 24 and 25 where, because of the rough terrain, the road was not completed. The road was found to be impassable in lots 28 and 29.

The projection of the Gloucester fault would cross the road in lot 23 and north of this point bedrock directly under the drift is Carlsbad shale. South of the fault to the boundary of the township, beds of the Nepean, March, and Oxford formations, in that order, directly underlie the drift.

The thickness of drift along the road in lots 6 to 8 varies from 2 to 14 feet and the elevation of the bedrock surface ranges from 262 to 285 feet above sea-level. Farther south, in lots 13 and 15, the thickness of the overburden increases to 80 feet and the elevation

of the bedrock surface falls to 217 feet in lot 13 and 211 feet in lot 15. In other words, the elevation of the bedrock surface has decreased 68 feet in $1\frac{1}{2}$ miles. This decrease is probably gradual rather than a sudden change at any one place. Nothing is known concerning the bedrock surface between lot 15 and the Gloucester fault. In the vicinity of the fault the drift is thin and outcrops are numerous.

The unconsolidated material exposed along the road is till at the north end at the city limits and marine clay overlain by various thicknesses of sand and swamp deposits in the central part. Till again occurs along the extreme south part of the road.

A few wells dug in the northern exposure of till are reported to be yielding excellent quantities of potable ground water. Most wells are dug to the surface of bedrock and some have actually penetrated its surface. The first few feet of bedrock is reported to be soft and easily dug. A well dug in this area 14 feet deep, encountered bedrock at 4 feet, and is reported to be supplying the needs of an entire farm.

There is no shortage of ground water between lots 9 and 15, where the drift consists of extensive beds of sand overlying clay. In this area, the wells are all of the shallow, dug type, ranging from 6 to 14 feet in depth, and are reported to be obtaining their ground water from saturated sand beds directly overlying the clay. The ground water, when encountered, was not under pressure and the wells have been classified as non-artesian. No intermittent wells were reported. The well at the Roman Catholic school in lot 15, con. V (R.F.), was constructed by driving a small diameter pipe through the clay to bedrock. Ground water under sufficient pressure to reach within a few feet of surface was encountered at the contact of clay and bedrock.

Because of the poor quantity of the soil and the consequent lack of farms, only a few wells occur between lots 16 and 30 at the south boundary of the township. These are all of the shallow, dug

type and are reported to be yielding sufficient quantities of potable ground water for domestic use and for small farms.

BASE LINE ROAD

The Base Line Road runs south of the community of Ramsayville to the south boundary of Gloucester township. North of Ramsayville, it extends a distance of approximately 1 3/4 miles. It separates Rideau Front from Ottawa Front.

Bedrock directly underlying the drift along the Base Line Road is composed entirely of the Carlsbad formation, except for a small area at the south end where the Nepean sandstone is brought up by the Gloucester fault, which crosses the road in lot 29.

A shallow, drift-filled valley apparently exists in the bedrock surface at the north part of the road, and in it few wells have been drilled to bedrock. This is part of a wider valley in the bedrock surface that underlies the area between Ramsayville and Blackburn in the north-central part of the township. Bedrock was reported at a depth of 165 feet in lot 9, con. VI (R.F.), at a point about ½ mile south of Ramsayville, and at depths of 157 and 138 feet in lot 12, about 3/4 mile farther south. The bedrock surface rose about 30 feet in elevation in this 3/4 mile.

Drift is thick along the southern part of the road. In lot 23, con. VI (R.F.), bedrock was reported at 60 feet but this figure is of doubtful accuracy. In lot 20, con. VI (R.F.), in the immediate vicinity of the Gloucester fault, bedrock was reported in two drilled wells at a depth of 97 feet, which corresponds to an approximate elevation of 170 feet above sea-level.

The unconsolidated material exposed along the road consists of sand overlying marine clay. The sand beds are particularly extensive in lots 13 to 15 and 17 to 24. All wells dug in these areas

supply adequate quantities of ground water, chiefly from saturated sand beds lying immediately above the clay. Wells dug in areas where the sand is thin, and which are dependent, in part, upon the clay as the source of their water supply, are deeper than those in the more sandy areas. Farm wells dug in the clay should be at least 22 feet deep, in order to take full advantage of the maximum lift of the shallow well pumps generally in use in the area.

Sand is the chief source of ground water for wells of the shallow, dug type along the road between lots 21 and 30, con. VI (R.F.). Quantities of potable ground water sufficient for the needs of the present owners are generally obtainable from this material. Much larger supplies of ground water could probably be obtained from the sand if the need ever arose.

The most important aquifer for wells drilled along this road and the one from which the largest quantities of ground water are obtained is the 'black gravel' lying between bedrock and considerable thicknesses of marine clay. Wells obtaining their ground water from these gravels are located along the north end of the road between lots 7 and 14. The water was reported as being under considerable pressure when first encountered and to be sufficiently salt to be disagreeable to humans but not enough to be objectionable for stock purposes. The pressure exerted on the water in this aquifer is believed to be due, in part, to the presence of considerable volumes of inflammable gas. Some well owners report that there was sufficient gas present where the well was first drilled for it to be ignited and burn for some time with a reddish blue flame. This gas is believed to be the accumulation of gas seepages from the underlying bedrock formations into the porous materials immediately beneath the impervious capping of marine clay.

A well reported to have been drilled in 1900 and 1901 to explore the oil and gas possibilities in the area is located in lot 18,

con. VII (O.F.), near the Base Line Road, on what is now the farm of C. R. Nicholson. Little is known about this particular well except that it was drilled to a depth of 1,744 feet and then abandoned when it was thought that all the bedrock formations likely to contain oil and gas had been penetrated.

The gravel beds between the clay and underlying bedrock are reported to average 18 feet in thickness. They are thought to be glacial outwash material, similar in origin to gravel beds immediately overlying bedrock in other parts of the township. The generally dark colour of the material is due to the predominance of grey and black shale fragments derived from local bedrock formations.

The following is a summary of the depths in feet of wells along the Base Line Road:

| | Dug | | Drilled |
|---|---|---|---|
| | Sand | Clay | |
| Min. | 6 | 7 | 80 |
| Max. | 16 | 24 | 208 |
| Ave. | 10 | 16 | 131 |

MONTREAL ROAD

The part of the Montreal Road described in this report runs east from the Ottawa city limits in l t 20, con. I (O.F.), to the village of Orleans in lot 4, cons. I and II (O.F.). The area discussed in this section includes Hiawatha Park and the Vehicle Proving Grounds of the Department of National Defence. A brief

report on the water supply of the Proving Grounds was prepared by B. R. MacKay[1] in 1944.

Although the Montreal Road roughly parallels the strike of the underlying Palaeozoic bedrock formations, the orderly sequence of these formations is much disturbed by faults, as a result of which at least four different bedrock formations directly underlie the drift along the road. At the extreme east end bedrock at the village of Orleans is partly the Oxford and partly the Rockcliffe formations. West of Orleans, bedrock is the Rockcliffe and Ottawa formations with small areas of St. Martin.

The relief of the bedrock surface is relatively great. Two drift-filled valleys are indicated by wells separated by an area where the bedrock outcrops or is thinly covered. One valley is believed to exist beneath lots 5 and 6, about $\frac{3}{4}$ mile east of the Vehicle Proving Grounds. In this area, a well drilled in lot 5, con. II (O.F.), encountered bedrock at a depth of 180 feet and a second well in lot 6, con. II (O.F.), at a depth of 192 feet. The elevations of the bedrock surface in these two wells are 37 and 21 feet above sea-level respectively. The second valley is thought to occur beneath lot 17, where two wells drilled to depths of 237 and 220 feet failed to encounter bedrock. If this information is correct, and there is no reason to believe it is not, bedrock surface beneath the deeper hole would be no higher than 7 feet below sea-level. This is the lowest elevation found for the bedrock surface anywhere in the township. Little information was obtained as to the size of these valleys but they appear to have a

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[1] MacKay, B.R.: Possible Sources of Water Supply at the National Defence Proving Grounds, Orleans, Ontario; Geol. Surv., Canada, Dec. 1944.

general southerly trend and may connect with the shallower valley believed to occur in the east-central part of the township under the Borthwick and Russel Roads.

Numerous outcrops of the Ottawa formation occur in the area between the two valleys, and in this area lies much of the Vehicle Proving Grounds.

In lot 18, the bedrock surface rises from east to west some 130 feet in $\frac{1}{4}$ mile, and west of these in lots 19 and 20 along the Montreal Road the drift is thin and outcrops numerous.

The unconsolidated materials exposed along the Montreal Road consist chiefly of various thicknesses of sand overlying marine clay. In the wide, flat plain between Ottawa River and the irregular, north-facing bluff, which, in places, closely parallels the road, the sand overlying the marine clay is thin. The drift is clay till in lots 10 and 11 and 19 and 20, where bedrock is close to the surface. Considerable sand is exposed along the south side of the road between lots 4 and 7 and extends southerly in a wide band across the Vehicle Proving Grounds to the Blackburn Road.

Many wells occur along the road between lots 5 and 10, which includes the area between the village of Orleans, the Vehicle Proving Grounds, and Hiawatha Park on Ottawa River. Most of the wells in this area obtain water from the drift, which in this area consists of south of the road and a flat clay plain north to Ottawa River. The clay contains interbeds, of silt and sand and gravelly material below the clay lying directly on bedrock, and these are the chief aquifers supplying water to the wells. Most of the wells are dug or bored and are reported to be capable of yielding fair supplies of soft, sulphurous water.

Some of the wells drilled into the gravel beds beneath the clay have encountered ground water under sufficient pressure to form

flowing-artesian wells. Wells of this type occur between the extensive areas of sand mentioned above and Ottawa River. It is thought that the sand is the intake area and its greater elevation provides the hydraulic head for the flowing-artesian wells to the north. The sandy area is the source of a number of small streams draining toward the Ottawa and evidently contains plenty of ground water. The sand beds do not, however, appear to be sufficiently thick for the development of large water supplies by drilled wells. A much better location for such wells would be in the flat clay area below the bluff immediately north of the road.

During the summer of 1951, measurements were made of the quantity of water issuing from some of the flowing-artesian wells in Gloucester township. These measurements are given in table on page 100 of this report.

Ground water from the drift between lots 5 and 10 is reported to be of better quality than that from the underlying bedrock. The result of this is that most wells along this part of the road are of the shallow, dug type. Only two wells, both in lot 10, are definitely known to have penetrated bedrock, and the ground water from both is reported to be soft but to have too high a content of dissolved minerals to be fit for drinking. One well, drilled to a depth of 308 feet at the Holy Rosary Scholasticate, is believed to have encountered the Ottawa and Rockcliffe formations, and possibly the underlying Oxford. The second well, used by personnel at the Vehicle Proving Grounds, was drilled to a total depth of 250 feet. It was reported to have penetrated 110 feet of clay and sand and 140 feet of the Oxford formation. The water is not suitable for drinking or domestic use.

The Ottawa formation is close to surface in lots 11 and 12 and, consequently, all but two wells along the road in this area are

drilled into bedrock. The potability of the ground water derived from bedrock in this locality is much better than that farther east and it is used extensively for both domestic and farm use.

The thickness of the drift increases considerably in the immediate vicinity of Green Creek and all wells in this area, with the exception of one, are dug or bored into the clay. The depths of the dug wells range from 7 to 30 feet with an average of 20 feet. Bored wells vary from 27 to 42 feet in depth and, although only approximately 12 inches in diameter, are reported to yield potable water in sufficient quantities. Most of the water yielded by wells in the clay is believed to be derived from interbedded silty and sandy layers. In other parts of Gloucester township where such layers are infrequent or absent satisfactory supplies of ground water may not be obtainable from shallow wells. The only drilled well in this locality was reported to be 355 feet deep with bedrock encountered at a depth of 136 feet. The water was reported to be soft but too saline for drinking.

The most satisfactory supplies of ground water in lot 16 come from comparatively shallow wells dug or bored into marine clay. Wells drilled into bedrock or into gravel beds immediately overlying bedrock are reported to be yielding ground water with an extremely high mineral content. Ground water derived from the bedrock is rarely used but that from the overlying gravel beds is used for stock purposes in some places. This suggests that the salinity of the ground water from the ground is not as high as that from bedrock.

In lot 17, two wells drilled to depths of 237 and 220 feet, respectively, were reported to obtain large quantities of ground water from gravel beds beneath approximately 175 feet of clay. The water was reported as soft and sufficiently potable for drinking.

The elevation of the bedrock surface rises westward across lot 18 and the drift is, consequently, thin along the Montreal Road in lots 19 and 20, bedrock being exposed in many localities. Sufficient ground water for the average house is yielded by wells drilled along this part of the Montreal Road as well as in the subdivision to the north known as Rothwell Heights. However, the quantity of ground water available is not unlimited, and care is exercised by well owners to assure an adequate supply at all times. The depths of twelve wells in Rothwell Heights for which information was gathered range from 110 to 312 feet, with an average of 179 feet. The Ottawa formation outcrops in this part of the township but two deep wells, drilled to depths of 308 and 312 feet in Rothwell Heights, are believed to have penetrated to the underlying Rockcliffe formation before sufficient supplies of ground water were obtained. The first beds to be encountered in the Rockcliffe consist of greenish shale. Ground water was reported to occur in limestone beds of the Ottawa formation directly above the shale as well as in sandy beds of the Rockcliffe beneath it. Bedrock in this area has a shallow dip to the south and it has been suggested that the ground water contained in the Rockcliffe is influent seepage from the Ottawa River percolating southward down the dip of the beds. The writer believes this unlikely because the Rockcliffe does not outcrop along the river but is covered by thick beds of impervious marine clay.

Supplies of ground water occurring in the bedrock, in lots 19 and 20, are limited, probably because that locality is cut into blocks by several closely spaced vertical faults, each of which forms an effective seal against the movement of ground water. Each fault block must, therefore, rely upon local precipitation for the replenishment of its ground water supply and cannot draw from some more distant source.

A well about $\frac{1}{4}$ mile south of the Montreal Road, in the Cardinal Heights subdivision, close to the east limits of the city of Ottawa, was drilled to a depth of 300 feet. It was reported to be a large capacity well intended by the owners for use as a 'master well' to supply several homes in the new subdivision.

Most wells along the Skead Road, which runs north from the Montreal Road to Ottawa River immediately east of the Ottawa city limits, are of the shallow, dug type. These wells are all reported to obtain satisfactory supplies of ground water from the marine clay. Two wells drilled to depths of 125 and 150 feet were reported to derive large quantities of potable ground water from the Ottawa formation.

ROAD BETWEEN CONCESSIONS II AND III (OTTAWA FRONT)

This road, sometimes known as the Blackburn Road, crosses the north part of the township in a northeasterly direction from the Ottawa city limits to the east boundary of Gloucester township. It intersects the Navan Road in lot 11.

Along the east part of the road between lots 1 and 12 the drift is underlain by the Ottawa formation and farther west by the Billings. The contact between these two bedrock formations is a southeasterly trending fault that crosses the road in lot 12[1]. The Carlsbad formation, which overlies the Billings, occurs only beneath that part of the road inside the limits of the city of Ottawa.

Depths to bedrock range from zero in the area between lots 1 and 7, where bedrock outcrops at the surface, to 118 feet in the vicinity of Blackburn where the fault described above is reported to occur. Elevations of the bedrock surface along the road between lots

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[1] Wilson, A.E.: Ottawa Sheet, East Half; Geol. Surv., Canada, Map 413A, 1938.

8 and 10 indicate a drop to the west of approximately 100 feet within 1 mile. This is believed to be caused by a steep bluff on the bedrock surface, possibly at the trace of the fault. Information from drillers and comparison of the chemical qualities of the ground water yielded by wells drilled into bedrock suggest that the strike of the fault changes abruptly from southeast to east immediately south of the road near Blackburn.

There is probably also an east-facing bluff in lots 18 and 19, for the elevation of bedrock surface drops from 182 to 119 feet above sea-level within a distance of $\frac{1}{2}$ mile. Bedrock outcrops immediately west of this bluff in the vicinity of Green Creek. The valley in the bedrock surface between the two bluffs is 100 to 130 feet deep and is reported to be filled with marine clay except for minor amounts of outwash sand or till at the contact of overburden and bedrock. Between Green Creek and the Ottawa city limits the thickness of the drift varies from 18 to 40 feet.

The unconsolidated material exposed along the road is chiefly marine clay overlain, in some areas, by thin, irregular beds of marine sand. The eastern limit of the sand is lot 8 where the bedrock exposed to the east dips under the overburden. Sand appears on the surface from lot 8 west to the vicinity of Blackburn where it reaches a thickness of approximately 12 feet. Till is exposed along the east part of the road between lots 1 and 8 where bedrock outcrops or is relatively close to surface. Till and occasional deposits of marine clay also occur at the west end of the road near the Ottawa city limits.

The type of well found along the east part of the road, from lots 1 to 6, depends to a considerable extent on the proximity of bedrock to the surface. Most wells are of the shallow, dug type and are bottomed on bedrock. Ground water is reported to enter the well at the contact of the overburden with bedrock. Some wells were

reported to obtain limited supplies of ground water from the drift. Although the drift directly above bedrock has been mapped as till and the surface exposures look like till, many well owners reported that it was necessary to dig through clay encountering bedrock. It is believed that this material is chiefly clay till some of which may be comparatively free of boulders and rock fragments. In some localities thin layers of clay were reported to overlie till-like material.

Some wells dug in localities where the drift is over 20 feet thick were reported to have encountered thin beds of sand lying immediately above bedrock. Excellent supplies of ground water are obtained from some of these sandy beds, and it may be under sufficient pressure to rise some distance in the well. One well 20 feet deep, in lot 2, con. II, was reported to flow during the spring. These sand beds are probably not continuous and will not be encountered in all wells.

Wells along the east end of the road that have proved to be intermittent are not sufficiently deep. To assure a greater supply of ground water, such wells, and wells that have been described as 'low in summer', should be deepened. The most opportune time to do this is generally late in the summer when the water-table is at its lowest point.

The following is a summary of the depths, in feet, of the shallow, dug wells along the road from lots 1 to 6 inclusive:

| | Clay | Clay till | Contact, overburden and bedrock | Intermittent wells |
|---|---|---|---|---|
| Min. | 6 | 7 | 8 | 6 |
| Max. | 16 | 12 | 20 | 11 |
| Ave. | 11 | 10 | 12.5 | 9 |

A number of flowing-artesian wells follow a line parallel with the road about ½ mile south of it on a flat, clay plain. These wells

were constructed by the owners to supply water for their cattle in the fields and are formed by driving a small diameter pipe through the clay to the bedrock surface. They were reported as flowing-artesian, but when examined in September 1952 most of the wells were not flowing although the surface of the water was only a few feet below ground level.

Hard, clear water in limited amounts was reported as being obtained from three wells drilled into bedrock along the road between lots 1 and 6. The casing in these wells has apparently been driven sufficiently tight into bedrock to prevent ground water from entering the well at or near bedrock surface. The water is, consequently, being derived from minute cracks along bedding and joint planes in the massive limestone, none of which is sufficiently large to transmit much ground water. A brief description of the wells drilled in this area is as follows:

| No. | Owner | Lot | Con. | Depth of well (feet) | Depth to bedrock (feet) |
|---|---|---|---|---|---|
| (1) | A. Parisien | 3 | III(O.F.) | 68 | 1 |
| (2) | E. Ouilette | 3 | III(O.F.) | 60 | 20 |
| (3) | N. Groulx | 4 | III(O.F.) | 70 | 0 |

A few, shallow wells, in the area where bedrock is relatively close to surface, were dug to bedrock and then further deepened by blasting into the rock. The depths of such wells range from 10 to 12 feet. They are reported to supply quantities of ground water sufficient for normal domestic and farm use.

There are few wells along the road between lot 7 and the junction of the Blackburn and Navan Roads. This is mainly because much of the land north of the road in lots 9 and 12, con. II (O.F.), is occupied by the Vehicle Proving Grounds of the Department of

National Defence and because the occurrence of extensive deposits of sand render the area as a whole unsuitable for farming and truck gardening.

Much ground water is reported to occur in the sand immediately above its contact with the marine clay, but it has proved difficult to construct a well sufficiently deep in this sand to obtain satisfactory supplies. Most of the sand is saturated with ground water and is so fluid that it is difficult to dig a well deep enough to obtain a supply of water. An example is the well located at the Blackburn Protestant School. This well was dug in sand and lined with 30-inch diameter, concrete tile. At 12 feet the sand flowed into the well so fast that further digging was impossible and only a limited supply of water was obtained.

Information was obtained on some forty-four wells in the undulating clay-sand plain that extends from Blackburn west to Green Creek. Some of the homes located in lot 13, con. II (O.F.), north of the road, along the top of a 20-foot clay bluff, have difficulty obtaining sufficient quantities of ground water from wells dug in the clay. Larger supplies of ground water could have been procured for these houses had the wells been sited back farther from the edge of the bluff. The surface material becomes more sandy north of the bluff, which, from examples in other parts of the township, would suggest that more ground water would be available there. Furthermore, the water-table should be closer to the surface away from the bluff. Wells there should be dug as deep as possible to create a reservoir of free water large enough to lessen the chance of a ground-water shortage during dry periods or when more than ordinary amounts were required.

In lots 14 and 15, considerable quantities of ground water are being derived from shallow deposits of sand overlying clay. Many of the wells in this area are in the cellars of the houses, which

suggests that the supply of ground water is plentiful. Farther west, in lot 15, wells have been dug through thin sand beds into clay. The well has then been deepened by augering a hole into the clay at the bottom of the well, thus creating a larger reservoir of free ground water. The need for such a reservoir does not necessarily mean a lack of ground water in the area but rather that the material exposed on the sides of the well will not yield its water readily.

In lots 16 and 17, the beds of sand overlying the clay are very thin and discontinuous. The best wells are where the sand is thickest. A few shallow wells dug where there is little or no sand are reported to be intermittent and a well 6 feet deep in lot 17, dug in clay, was reported to be dry.

Farther west between Green Creek and the Ottawa city limits, shallow, dug wells are reported to be deriving their water supply from the contact of the drift and bedrock.

Except for that part of the road immediately west of Blackburn, bedrock directly underlying the drift between Blackburn and Green Creek is not a good source of potable ground water. A well 75 feet deep in lot 12, con. II (O.F.), near Blackburn, encountered Ottawa limestone at 50 feet from surface. The hard, clear water yielded by this well is reported to be coming entirely from the bedrock. Just west of there in lot 13, con. III (O.F.), a well drilled 106 feet encountered black shale of the Billings formation, and yields water that is brownish in colour and has a strong odour of hydrogen sulphide gas. It is used for stock purposes only. A well in lot 15, con. III (O.F.), still farther west, reported to have been drilled to a depth of 230 feet, is yielding water with a saline taste and a distinct odour of hydrogen sulphide gas. Two of the deepest wells drilled for water in Gloucester township are along the Blackburn Road. One, in lot 19, con. II (O.F.), was reported to have been put down to a depth of 332 feet. Bedrock,

consisting of brownish shale, was encountered at 84 feet but the rock in the bottom part of the well was reported to be grey limestone. The ground water yielded by this well is clear and fairly soft. A second well, on the farm of Emerson Woodburn in lot 21, con. II (O.F.), was drilled to a reported depth of 709 feet. No information was obtained about this well except that it yields unlimited supplies of soft, clear ground water.

It should be noted that the ground water derived from the bedrock directly under the drift along the road west of Green Creek does not contain hydrogen sulphide gas, which renders much of the ground water derived from bedrock farther east unpalatable. It may be that the Carlsbad formation occurs here instead of the black shale of the Billings formation.

Wells drilled to bedrock in lot 22 were reported to have encountered ground water under considerable pressure in sand beds between marine clay and bedrock. The pressure of the water was sufficient to force the sand considerable distances up into the casing, thus rendering it difficult to obtain sufficient supplies of ground water. To overcome this difficulty, the casing in most wells has been driven tightly into bedrock. This procedure although effective in shutting off the sand also shuts off the water contained in this material. Consequently, the ground water delivered by such wells must come from bedrock and is mostly poorer in quality than that contained in the sand.

## CYRVILLE ROAD

The part of the Cyrville Road described in this report extends in a southeasterly direction from the community of Cyrville across con. II (O.F.), to its junction with the Blackburn Road in lot 22. The length is approximately 1 3/4 miles.

The drift is comparatively shallow with bedrock, consisting entirely of the Billings formation, reported to lie at depths ranging from 20 to 43 feet.

The drift consists of till overlain with thin, irregular beds of clay and sandy clay. The gravelly character of the till makes it a fair source of ground water and, consequently, wells dug in this material can be expected to yield satisfactory supplies from relatively shallow depths. The sandy clay also yields dependable supplies of ground water to pumping wells.

Bedrock surface is flat with a relief of only 17 feet in 1 mile. It has been penetrated along the road by six drilled wells. The shallow wells yield ground water containing considerable quantities of hydrogen sulphide gas but the deeper wells provide water reported to be soft with only faint traces of hydrogen sulphide. It is possible that the black shales of the Billings formation, which directly underlie the drift along this part of the road and which are considered to be the chief bedrock source of hydrogen sulphide gas, are thin in this area. If this is the case, the deeper wells have doubtless passed through the Billings and are obtaining their ground water from the underlying Carlsbad formation.

Bedrock in this area is not a good source of ground water. The deepest well, which penetrated bedrock, was drilled to a depth of 140 feet and was reported as intermittent.

The following is a summary of the depths of wells and the depths to bedrock, in feet, along the Cyrville Road:

| | Dug wells | | Drilled wells | Depth to bedrock in feet |
|---|---|---|---|---|
| | Depth in feet | | Depth in feet | |
| | In sandy clay | In till | In bedrock | |
| Min. | 8 | 5 | 72 | 20 |
| Max. | 13 | 22 | 140 | 43 |
| Aver. | 10 | 10.5 | 102.5 | 27.5 |

NAVAN ROAD

The part of the Navan Road described in this report starts in lot 15, con. II (O.F.), immediately west of the Proving Grounds, and crosses cons. II, III, and IV (O.F.), in a southeast direction to the east boundary of Gloucester township in lot 1, con. IV (O.F.).

Bedrock directly underlying the drift throughout the length of the road has been mapped as the Ottawa formation[1]. However, the presence of considerable quantities of hydrogen sulphide gas in the ground water yielded by wells drilled into bedrock in the vicinity of Blackburn suggests that the drift there is underlain directly by the Billings. It is possible that in this area there has been a change in the direction of the fault separating the Billings and Ottawa formations.

Few wells have been drilled to bedrock along the road and, consequently, the thickness of drift in most localities is unknown. In the vicinity of Blackburn, depths to bedrock are reported to range from 50 to 188 feet, being greatest in lot 10, con. III (O.F.). No bedrock outcrops were observed.

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[1] Wilson, A. E.: Ottawa Sheet, East Half; Geol. Surv., Canada, Map 413A, 1938.

Marine sand is the chief unconsolidated material exposed along the road. It is particularly extensive between Blackburn and the east boundary of the township. Some of the deeper wells dug along this part of the road were reported to have encountered clay beneath the sand. The sand beds decrease in thickness northwest of Blackburn and clay is close to surface at many places.

In con. IV (O.F.), the Navan Road extends southeast from the north edge of lot 5 to the centre of lot 1. Information was obtained on many dug wells along this part of the road, all of which obtain their water supply from sand overlying clay. About 50 per cent of these wells were reported to have been dug to the top of the clay beds. Most of the remaining wells did not reach the clay, chiefly because of difficulties in attempting to pass through the zone of saturated sand immediately above it. It was necessary to dig the well into the underlying clay only where the sand covering is thin.

Most of the water supplying these wells comes from the lower few feet of sand immediately above the clay where much of the sand is completely saturated with water. The few wells that have penetrated the clay are reported to obtain limited quantities of water from cracks extending down into it. In some areas the part of the clay beds immediately under the saturated sand has been reported as soft and fluid but in most instances it is solid.

The wells are all non-artesian, that is the source of the ground water is the zone of saturation below the water-table. There is no evidence that the water is perched although in some instances it may be considered as 'semi-perched', where the downward movement of the ground water through the sand has been so slowed by the relatively impervious clay that the water-table is slightly higher than it would be if no clay were present.

The quality of water from these wells was reported to vary from soft to medium hard with no offensive odour except from poorly constructed wells.

The quantity is sufficient for a normal household and no pressure systems were noted along the road. About half the wells are pumped by hand and the remainder bailed.

Thickness of sand overlying marine clay (in feet)
lots 1 to 5, con. IV (O.F.)

| | Lot 1 | Lot 2 | Lot 3 | Lot 4 | Lot 5 |
|---|---|---|---|---|---|
| Min. | 6 | 9 | 5 | 4 | 2 |
| Max. | 9 | 10 | 13 | 9 | 2 |
| Aver. | 7.5 | 9.5 | 9 | 6.5 | 2 |

Depths of 51 dug wells (all in sand), in feet,
lots 1 to 5, con. IV (O.F.)

| | |
|---|---|
| Min. | 4.5 |
| Max. | 18 |
| Aver. | 9.5 |

No drilled wells were reported along the road. This is because satisfactory quantities of potable ground water can easily be obtained from the less expensive, shallow, dug wells.

Most wells located along the Navan Road between lots 6 and 10, con. III (O.F.), are similar to those previously described between lots 1 and 5, con. IV (O.F.). The material exposed on the surface is predominately marine sand overlying clay. Ground-water supplies are chiefly obtained from wells dug into saturated sand beds immediately above the clay. The depths of these dug wells range from 9 to 17 feet, with an average of 13 feet.

Near Blackburn, several wells have been recently drilled to bedrock to obtain ground water for some houses under construction. In most instances the water is unsatisfactory for domestic use because of the hydrogen sulphide gas associated with it.

A general log of the wells drilled in the area about Blackburn is as follows:

| Feet | | |
|---|---|---|
| 0 to 12 | .............. | sand; some water |
| 12 to 30 | .............. | red clay; no water |
| 30 to 110 | .............. | blue clay; no water |
| 110 to 120 | .............. | hardpan; no water |
| 120 to 123 | .............. | fine, white sand; little water |
| 123 plus | .............. | black shale; water with hydrogen sulphide gas |

Two drilled wells in lots 11 and 12, con. II (O.F.), northwest of Blackburn, are reported to obtain excellent supplies of hard, clear ground water from the bedrock directly underlying the drift. It is believed these wells were drilled into the Ottawa formation whereas the Billings was encountered in those wells whose waters contain hydrogen sulphide gas.

The occurrence of ground water along the Navan Road between lots 11 and 15, con. II (O.F.), is limited. The unconsolidated material exposed along this part of the road consists of thin beds of sand overlying clay, which, in turn, is thought to overlie rocks of the Ottawa formation. Only three wells are known along this section of the road; all are dug and one has been reported as intermittent.

ROAD BETWEEN LOTS 6 AND 19, CONCESSION III (O.F.)

This road extends from its junction with the Navan Road in lot 6 southwest along the boundary between cons. III and IV (O.F.), to lot 10, and hence west across con. III to lot 19 where it joins the Blackburn Road in the vicinity of Green Creek.

The Billings formation underlies the drift along the entire length of the road. Elevations of bedrock surface, ranging from 128 to 137 feet above sea-level, were computed for some wells drilled in lots 11 and 12, and are slightly lower than those in the floor of the shallow valley believed to lie beneath the Blackburn Road about 1 mile to the north. The thickness of the overburden along the road is about

90 feet.

Overburden along the road consists of water-laid material, chiefly marine clay overlain by irregular beds of sand. Clay is the dominant material exposed between lots 6 and 9 farther west; sand is more common and reaches its maximum extent between lots 16 and 19. Clay is again exposed in the valley of the east branch of Green Creek in lots 15 to 18. Beds of outwash gravel, up to 5 feet, were reported between the marine clay and underlying bedrock in some localities along the road.

Sand is the chief source of ground water for the dug wells. The shallower of these wells reached the underlying clay but few of the deeper wells, because of the fluid condition of the saturated sand, reached the clay. The thickness of the sand beds varies greatly. In lot 13, they are reported to be at least 23 feet thick but in lot 14 to be only 10 feet thick. The water from the sand is clear and fairly hard and there is enough to satisfy the demands of normal usage. Little ground water was reported from the clay.

Several small springs or seeps issue from the contact between the sand and underlying clay in the valley of the east branch of Green Creek. The aggregate flow of these seepages is sufficient to maintain small stream during the greater part of the year.

Information is limited concerning two drilled wells in lots 6 to 7, con. IV (O.F.), but the water from these wells, whose depths were reported as 150 and 300 feet respectively, contains considerable quantities of hydrogen sulphide gas. It is, accordingly, assumed that both wells are in Billings shale from which at least part of the water is derived.

Most wells drilled to bedrock are in lots 11 and 12. The quality of the ground water has been variously described as soft, hard, saline, and containing considerable quantities of hydrogen sulphide gas.

It is believed that the water contaminated with the hydrogen sulphide is derived chiefly from bedrock whereas the other water is chiefly from gravel beds lying between the clay and bedrock. The quality of this ground water is similar to that yielded by gravel beds drilled to the south along the Russell and Baseline Roads.

The log of one well in lot 11, the water from which was reported as saline, is as follows:

| Feet | | |
|---|---|---|
| 0 to 85 | ..................... | clay |
| 85 to 90 | ..................... | gravel with saline water |
| 90 plus | ..................... | bedrock |

The gravel beds underlying the clay do not always contain ground water. On one farm in lot 14 four dry wells were drilled into the gravel.

A well located in lot 18, con. III (O.F.), at the junction with the Blackburn Road, was drilled to a depth of 156 feet with bedrock reported at 100 feet. The water from this well is clear but saline, suggesting that it is coming from gravel beds beneath the clay rather than from bedrock.

## SECOND RIDGE ROAD

This is a short, well populated road that crosses the east-central part of Gloucester township westerly from lot 7, con. V (O.F.), to lot 15, con. IV (O.F.), about ½ mile south of Blackburn Station. The road has been called 'Second Ridge Road' primarily to differentiate it from the Ridge Road (Borthwick Road), which parallels it about 1 mile to the south. Both roads are similarly situated along the top of a north-facing bluff on the north side of parallel sand-covered ridges.

Bedrock directly underlying the drift along the entire

length of the road consists of the Billings formation, but no outcrops are known.

Overburden exposed along the road consists chiefly of marine clay overlain by irregular beds of sand. The thickness of the overburden as indicated from the log of a well drilled in lot 11, con. V (O.F.), is about 180 feet. Clay is close to the surface at the east end of the road but is overlain by thick beds of sand along that part west of lot 12. The extent of the sand there is comparable with that of the sand exposed along the Ridge Road to the south.

The same difficulties are met in obtaining a satisfactory supply of ground water along the 'Second Ridge Road' as in other areas where sand beds overlie relatively impervious marine clay. The sand immediately above the clay is frequently saturated with water and flows into the well making it difficult to reach a depth where a sufficient supply of ground water can be obtained. It was also reported that in some wells where the tile lining was placed directly on the clay, a considerable part of the ground water in the overlying sand was prevented from entering the well. This problem could be solved to a great extent by the use of well screens.

A number of intermittent, dug wells occur along the east end of the road where the sand deposits overlying the clay are thin. In such wells the water-table probably drops in times of drought to a point where there is insufficient permeable material, saturated with water, exposed on the sides of the well to yield adequate supplies of water. To overcome this difficulty these wells should be deepened, into the clay if necessary, and thus create a larger reservoir of free water that would be available when needed.

No wells were reported to derive their entire supply of ground water from clay. Large quantities of ground water were reported to be available in the thick sand beds west of lot 12. Several small springs

and seeps, which usually indicate the contact of sand and underlying clay, occur along both flanks of the ridge. Most of these have not been plotted on the accompanying map.

Thickness of sand along the Second Ridge Road

(Feet)

| Lot | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|
| Min. | 2 | 9 | No information | 5 | 8 | No information | 5 | 9 |
| Max. | 3 | 9 | | 11 | 11 | | 5 | 9 |
| Aver. | 2.5 | 9 | | 7.5 | 7.5 | | 5 | 9 |

Depths of wells along the Second Ridge Road (all in sand), in feet

| | |
|---|---|
| Min. | 7 |
| Max. | 15 |
| Aver. | 11 |

Only one drilled well is known along the Second Ridge Road. This well, in lot 11, con. V (O.F.), was reported to be 200 feet deep with bedrock at 180 feet. Although the quality of the ground water is saline it is considered adequate for watering stock but not sufficiently potable for drinking. Overburden encountered in this well consisted of 175 feet of marine clay overlain by 5 feet of sand. The absence of hydrogen sulphide gas, generally associated with ground water from the black shales of the Billings formation, suggests the source of the water to be either the Carlsbad formation or gravel beds lying above the Billings. Gravel was not mentioned in the log of the drilled well and it is, therefore, assumed that the Billings formation is thin and the well has reached the Carlsbad.

RIDGE ROAD (BORTHWICK ROAD)

This road crosses the east-central part of Gloucester township in a westerly direction from lot 8, con. VI (O.F.), to the

Ottawa city limits in lot 1, con. VI (R.F.). Its west end is about $\frac{1}{2}$ mile southeast of the community of Hawthorne. Most of the road lies along the north edge of the crest of an elongated sand ridge.

Rocks of the Carlsbad formation directly underlie the drift along the entire road but no outcrops are known.

Except for small areas where the sand is thin and clay near the surface in lots 13, 14, and 15, at the extreme west end, the overburden consists of extensive beds of sand overlying marine clay.

There is no shortage of ground water along the east end of the road where the sand is thick. One well, dug 15 feet in the sand, was reported to yield sufficient quantities of potable ground water for both domestic and farm use. Numerous small springs and seeps along the bottom of the bluff on the north side of the ridge indicate the presence of substantial quantities of ground water. The sand overlying the clay is, however, thin in parts of lots 13, 14, and 15, con. V (O.F.), and it is in this area (lot 14) that the only intermittent well was reported. This well was dug 20 feet almost entirely in marine clay. In lot 16, the thickness of the sand is only about 4 feet, and shallow wells here must be dug some distance into the clay to form a large enough reservoir of free water to provide adequate supplies of ground water.

Depths of dug wells along the east half of the road between lots 8 and 15 range from 10 to 30 feet with an average of 14.5 feet.

Satisfactory supplies of ground water are reported from shallow wells dug in the drift along the west end of the road between lot 17 and lot 1, con VI (R.F.). Most of the water is from saturated sand beds immediately above the clay. Some wells have reached the clay, but in most instances the sand was reported to be too fluid to permit digging the well more than a few feet into it. In the spring the ground along the lower edges of the bluffs, where the contact of the sand and the underlying clay appears at the surface, is exceptionally

wet. Small gullies formed by the sloughing off of the saturated sand are common along the sides of the bluffs.

Borthwick Springs, in lot 19, con. IV (O.F.), on what was once the Borthwick farm, consist of several small springs and seeps, the water from which was once held in high esteem for its medicinal properties. The springs are no longer in use and when visited in September 1951 consisted of several small neglected pools of water situated in a flat, clay plain about 300 feet north of a steep north-facing bluff. There was no visible flow to the water, which apparently is seeping slowly out of the clay. The water has a saline taste not unlike that from gravel beds below the clay elsewhere in the township. The water for the springs is probably coming either from the underlying Carlsbad shale or gravel beneath the clay whose components are chiefly shale derived from the Carlsbad. Bedrock in the vicinity of the springs is thought to be about 50 feet from the surface.

Sand and gravel beds yielding large quantities of potable ground water were reported to have been encountered beneath the clay by several wells drilled along the road. However, they are probably not extensive and will not be encountered by every drilled well.

The writer believes that there are sufficient quantities of ground water to supply a larger number of houses than there are at present along the west half of the road. However, it must be pointed out that no surface drainage system that would remove much water from the saturated sand beds above the clay should be constructed.

Two long time residents of the Ridge Road have stated that the supply of ground water available in the drift was decreased noticeably during the past 25 years. Springs that formerly occurred along the bluffs have gone dry, and other areas that were commonly wet for part of the year are now always dry.

Seven drilled wells, all the wells of this type in the locality for which information was gathered, were reported along the

west half of the Ridge Road between lot 17, con. IV (O.F.), and lot 3, con. VI (R.F.). The elevations of the surface of bedrock in five of the drilled wells apparently decreases rapidly along the road east from lot 19, there being a drop of about 100 feet in 1 mile with a corresponding increase in the thickness of the drift. The absence of drilled wells along the east half of the road is doubtless because of this increase in the thickness of the drift and the east with which satisfactory supplies of ground water may be obtained from the sand.

The deepest drilled well in the locality is in lot 3, con. VI (R.F.), about $\frac{1}{2}$ mile south of the road. This well is 372 feet deep with bedrock at 40 feet. The water was reported to be soft and clear with a slight mineral taste. A general log of the well is as follows:

| Feet | | |
|---|---|---|
| 0 to 6 | ........ | sand; some water |
| 6 to 30 | ........ | clay; no water |
| 30 to 40 | ........ | clay and boulders (till ?); no water |
| 40 plus | ........ | shale; water at several horizons |

Excellent supplies of hard, clear ground water at a temperature of 43.5 degrees fahrenheit was reported from a well drilled to a depth of 105 feet in lot 20, con. IV (O.F.). The source of the water was stated to be a layer of compact gravel or hardpan below the clay. Carlsbad shale was encountered at 97 feet in a well drilled to a depth of 212 feet in lot 19, con. IV (O.F.). No gravel or hardpan was encountered. The water in this well was reported by the driller to come from the bedrock. It is only slightly saline. Slightly saline water was encountered in another well drilled to a depth of 186 feet in lot 7, con. IV (O.F.). It occurs in running sand underneath about 170 feet of marine clay.

RUSSELL ROAD

The Russell Road, which serves as a connecting link between the city of Ottawa and the communities of Hawthorne, Ramsayville, and Carlsbad Springs, is an important road in the east-central part of Gloucester township. It extends from the Ottawa city limits in lot 2,

con. VI (R.F.), to the east boundary of Gloucester township in lot 1, con. VII (O.F.). The road is well populated by farmers and by other persons chiefly employed in the city of Ottawa, and there are a relatively large number of wells along it.

The drift along the Russell Road, as along the Ridge Road on the north, is underlain by rocks of the Carlsbad formation. Depths to bedrock along the west part of the road, between the Ottawa city limits and a point in lot 6, con. VI (R.F.), about 1 mile west of the community of Ramsayville, range from 20 to 30 feet. East of this point bedrock drops off abruptly and the drift is from 180 to 197 feet thick for a distance of about $2\frac{1}{2}$ miles east of Ramsayville. It then gradually decreases until at Carlsbad Springs it is reported to be about 50 feet thick. Bedrock outcrops at only one place, a small creek in lot 4, con. VI (R.F.). A well drilled to a depth of 169 feet at Ramsayville failed to reach bedrock. The elevations of the bedrock surface at Carlsbad Springs are from 30 to 40 feet lower than west of Ramsayville.

The unconsolidated material exposed along the Russell Road consists of marine clay overlain in places by various thicknesses of sand. Except for small areas in lots 12, 14, and 15, the sand is not as thick as along the Ridge Road. The Russell Road, in part, lies along the top of a fairly steep, north-facing bluff believed to have been formed by Ottawa River when it was at a higher elevation. The material exposed on this bluff is marine clay with only a little sand here and there and, consequently, few springs or seeps were reported.

As the cover of sand is thin many shallow wells dug along the Russell Road obtain ground water from the clay and only three wells were reported to be intermittent. This is in contrast with other parts of the township where most wells dug in clay are reported as 'low in summer' or dry for a part of each year. The clay along the Russell

Road may not be as massive as elsewhere and may contain irregular lenses of silt and fine sand that yield their water content more readily to wells. This is true for the clay in the vicinity of Orleans along the Montreal Road.

The water from a few wells dug in the clay has a faint odour of hydrogen sulphide gas. This is probably due to decaying organic material carried directly into the well by surface water. Water from such wells may be contaminated and should be tested before being used for drinking.

Some farmers in clay areas have constructed small dug-outs or cisterns adjacent to their barns into which excess surface water from nearby fields is drained by a system of tiles or ditches. Water from them is pumped into the barn for stock use.

The entire water supply for Johnston's Hotel in Carlsbad Springs is reported to come from a well dug 15 feet in clay. This is unusual and it is believed that the source of much of the ground water is some more permeable material, such as sand, interbedded with the clay. It is possible, too, that the ground water in this well is coming from bedrock or gravel beds beneath the clay, the water being under sufficient pressure to force it up through the clay.

The northern extremity of a large area of sand south of the Russell Road occurs in lots 12, 14, and 15, and is yielding satisfactory quantities of ground water to several shallow wells dug into it. Most of the water occurs in the sand immediately above the clay. A well in lot 14, con. VI (O.F.), on the south side of the road is dug 10 feet into the sand, and yields enough ground water for both domestic and stock needs. This water is pumped a distance of 300 feet from the well to the house and barn on the north side of the road. In lot 11, enough ground water for domestic purposes is pumped from a well dug 12

feet in the sand some 900 feet south of the road.

Satisfactory supplies of ground water are being obtained from shallow wells dug on a small sand ridge about 3/4 mile north of the Russell Road in lots 10 and 11, con. VI (O.F.). The sand there is about 9 feet thick. This sand ridge continues east and passes about 200 feet north of the Carlsbad Springs Hotel where it is from 3 to 4 feet thick. The hotel obtains its water supply from the sand, through a network of tiles laid on the clay at the base of the sand on the hillside immediately behind the hotel. The water is drained into a shallow well at the foot of the bluff and thence pumped into the hotel.

Sand points are not used along the Russell Road. The sand is so fine that it would plug the screen and render the well useless.

Gravel beds containing ground water, and in many places considerable quantities of inflammable gas, have been encountered beneath the clay by several wells drilled along the road. The pressure of the water and associated gas combine to force the water up the well and at times to cause it to flow. The water issuing from one flowing-artesian well, in lot 2, con. VII (O.F.), east of the community of Carlsbad Springs, is coming from gravel beds beneath about 61 feet of clay. A second well, in Carlsbad Springs, 150 feet deep encountered Carlsbad shale at 50 feet. The water in this well has a high sulphur content and is believed to come from a different aquifer to that in the first well.

Wells drilled into bedrock along the Russell Road west of Ramsayville yield water containing both hydrogen sulphide gas and dissolved mineral salts. Bubbles issuing from the water commonly burn with a bluish flame. In this locality, more potable ground water is obtained from the upper parts of bedrock than deeper. Probably much

of the ground water encountered at depth has travelled a longer distance through the rock than water near the bedrock surface and has had a greater opportunity to dissolve mineral salts. In neither case is much ground water available.

The water from wells drilled to bedrock east of Ramsayville is more saline. In lots 18 and 19, con. V (O.F.), ground water is obtained at the bedrock surface by two wells 189 and 200 feet deep respectively. The water, although containing considerable dissolved mineral salts, is reported to be sufficiently potable for both drinking and stock.

Examples of the high mineral content of the ground water in the gravel and shaly bedrock underlying the clay and the pressures to which it is subjected at depth occur in the vicinity of Carlsbad Springs. There several mineral springs result from ground water being forced to the surface through cracks in the clay. These springs led to the development of Carlsbad Springs into a health resort of some prominence. At present there are three hotels, all with wells yielding ground water containing dissolved chemical salts, in the community. These wells are either springs that have been dug out or wells drilled through the clay. Excellent descriptions of the mineral content of these waters have been published by Satterly and Elworthy[1, 2].

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[1] Satterly, John, and Elworthy, R. T.: The Radioactivity of Some Canadian Mineral Springs; Mines Branch, Canada, Bull. No. 16, pt. I, pp. 16, 21 (1917).

[2] Elworthy, R. T.: The Chemical Character of Some Canadian Mineral Springs; Mines Branch, Canada, Bull. No. 20, pt. II, pp. 33, 164 (1918).

ROAD BETWEEN CONCESSIONS VI AND VII (OTTAWA FRONT)

This section describes that part of the road between lot 10 where it branches off the Russell Road and lot 20 where it joins the Base Line Road. The part east of lot 10 has been described in the section on the Russell Road.

The Carlsbad formation directly underlies the drift all along the road. The wide, shallow valley in the bedrock surface that lies beneath much of the central part of the township is believed to underlie this road and the drift is, consequently, thick. Bedrock was reported at about 110 feet in lot 10, con. VII, (O.F.), a figure that may not be true as it was obtained by driving a small diameter pipe down through the clay until it stopped. The elevation of bedrock(?) at this point is 138 feet above sea-level. A well drilled to a depth of 206 feet, in lot 16, con. VII (O.F.), did not reach bedrock and in lot 18 of the same concession a second well drilled to a depth of 1,744 feet reached bedrock at 200 feet. The second well is on the farm now owned by C. R. Nicholson. It is one of the deepest in the township and was drilled during 1900 and 1901 in a search for oil-bearing rocks. A log of the well is included in the back of this paper. The elevation of bedrock surface in this well is about 73 feet above sea-level.

Sand is the most common unconsolidated material exposed along the road and, except for small areas in lots 10, 17, and 18, constitutes the chief source of ground water for shallow, dug wells. Altogether, some twenty wells were reported to obtain satisfactory supplies of ground water from the sand. They range in depth from 8 to 28 feet with an average of 13 feet.

The thickness of the sand deposits along the road in lot 10, con. VII (O.F.), varies and one farmer in the area has had to dig a well 16 feet deep some 700 feet south of his buildings where the sand beds are thicker than nearer by to obtain his water supply.

Much sand is exposed on the surface in parts of lot 14, con. VII (O.F.). In this locality a well dug 15 feet in the sand yields sufficient ground water to supply the domestic and stock needs for a farm but is about a $\frac{1}{4}$ mile north of the buildings. This unusually great distance indicated the wide variation in the capacity of the different unconsolidated materials in the locality to yield satisfactory supplies of ground water. The clay underlying the sand is a poor source of water. In areas where the sand beds are thin, some wells have been dug into the clay, not with the hope of obtaining much ground water from it but to form a larger reservoir to store fresh water derived from the thin layer of sand. Clay is the source of water for a well dug 12 feet deep in lot 10, con. VII (O.F.). This well yields a limited supply of brownish water that emits a slight odour of hydrogen sulphide gas, possibly from decaying organic material carried into the well by surface water.

Excellent quantities of ground water under considerable pressure were reported in beds of 'black gravel' directly overlying bedrock. The water is usually accompanied by gas that burns with a pale blue flame. Because of the high confining pressure the gravel commonly comes up into the casing during drilling operations. To overcome this undesirable condition, the driller is compelled to drive the casing down to bedrock, and that prevents the water in the gravel from entering the well. As a result, such wells are entirely dependent upon bedrock for their ground-water supply.

The dissolved mineral content of the ground water from the 'black gravel' and from bedrock immediately underlying it is generally too great to allow the water to be used for domestic and stock purposes. For instance, a well 200 feet deep in lot 18, con. VI (O.F.), was drilled into bedrock. Beds of 'black gravel' containing large quantities of saline ground water under pressure were encountered in this well between 190 and 195 feet. However, in lot 15, con. VII (O.F.), a well drilled 206 feet through marine clay and into 'black gravel' yields water that

is only slightly saline and can be used by both humans and stock. The water is under considerable pressure and rises almost to the surface.

It is not definitely known if bedrock is the source of any ground water for wells drilled along the road. The upper part of the bedrock is soft and the drillers cannot be certain as to the exact depth at which bedrock was reached. It has been stated by various well owners that limited supplies of ground water can be obtained from bedrock, but no information has been received that would substantiate this.

ROAD BETWEEN CONCESSIONS VII AND VIII (OTTAWA FRONT)

This road, sometimes called the Piperville Road, extends across the southeast part of the township from its east boundary southwest to the Base Line Road.

The Carlsbad formation directly underlies the drift all along the road. Information regarding depths to bedrock along the road is scanty except at three wells drilled in lots 13 and 14, con. VII (O.F.), near Piperville. Bedrock was reported to have been reached in these wells at depths ranging from 100 to 120 feet. No information was available at a fourth well drilled in lot 7, con. VIII, (O.F.). The elevations of the bedrock surface beneath Piperville are 150 to 156 feet above sea-level, that is about 80 feet higher than beneath the road separating cons. VI and VII $1\frac{1}{4}$ miles to the north. Apparently the shallow valley in the surface of bedrock to the north is less definite here.

The overburden exposed along the road consists predominantly of marine clay overlain by various thicknesses of sand. Clay is close to the surface in lot 1, at the east end, where a covering of only 1 foot or 2 feet of sand was reported. The sand is 5 to 14 feet thick between lots 3 and 7. Clay is exposed on the surface in a small area in lot 8, con. VIII (O.F.), and also in the vicinity of Piperville. Thick sand deposits occur between lot 14 and the Base Line Road, the greatest thickness being in lot 18 where it was reported to be about 12 feet.

Fair quantities of ground water can be obtained from shallow wells along the road, the most satisfactory supplies being from where the sand is thickest. The water-bearing horizons are at the base of the sand immediately above the clay. Wells dug entirely in the clay, for example those in the vicinity of Piperville, are generally intermittent and yield brownish water that sometimes smells of hydrogen sulphide gas. The lack of satisfactory supplies of ground water at shallow depths in the Piperville area is no doubt why there are drilled wells in that locality. One farmer has supplemented his eater supply by a system of tiles and ditches through which excess surface water is drained from adjacent fields into a large diameter well dug in the clay. The water is used for stock.

No gravel beds were reported along the road between the marine clay and bedrock. These materials apparently exist only north of the road where they partly fill the shallow bedrock valley that extends through much of that area.

Plenty of ground water, most of which is, however, too saline to be used, is reported to occur at the contact between the drift and bedrock or in the upper few feet of bedrock. Two wells were drilled to bedrock on one farm in lot 14, con. VII (O.F.). The water from the first well contained so much dissolved mineral salt that it could not be used. That from the second has a saline taste but is sufficiently potable to be used by both humans and stock. Neither the confining pressures of the water beneath the clay nor the volume of gas associated with the water is as great as farther north where the (black gravel' was encountered.

No well was reported to penetrate bedrock very far and, consequently, little is known about the quantity or quality of ground water to be expected from the bedrock. It is doubtful, however, if large supplies of ground water could be obtained from this source.

ROAD BETWEEN CONCESSIONS VIII AND IX (OTTAWA FRONT).

The Carlsbad formation is believed to directly underlie the drift directly all along this road.

The thickness of the drift is not known, and bedrock does not outcrop anywhere, but, judging from the elevations of the bedrock surface at drilled wells along the two roads adjoining on the north and south, it seems probable that deeper wells drilled along the road being considered must have penetrated close to, if not into, bedrock.

The overburden exposed along the road consists chiefly of marine clay overlain by various thicknesses of sand. The sand is thickest along the east part of the road between lots 1 and 7, but decreases in thickness to the west and in many localities consists of mere layers of sandy loam overlying the clay.

All wells between lots 1 and 7 are of the shallow, dug type deriving their supply of ground water from the sand. Most farms have two such wells, one at the house and the other at the barn, which are reported to supply sufficient water for both domestic and stock purposes. No drilled wells were reported from this locality, which is a good indication that adequate supplies of potable ground water can be obtained from the sand.

Clay was reported in all dug wells west of lot 8 where the sand beds are thinner. Most of these wells are deeper than those at the east end of the road and do not yield as satisfactory a supply of ground water. The lack of overlying sand beds to filter the water has resulted in some instances in its being brownish coloured and smelling slightly of hydrogen sulphide gas. The shallow wells dug along this part of the road have been described as "intermittent" or "low in summer" and should be deepened if an increased supply is required.

Because most shallow dug wells are inadequate several wells have been drilled along the west part of this road. A well drilled to a depth of 90 feet in lot 9, con. IX (O.F.), yields large quantities

of soft, slightly mineralized ground water, reported to be coming from beds of gravel beneath the clay. In lots 11 and 13, con. IX (O.F.), two wells, drilled to depths of 135 and 70 feet respectively, were reported to yield ground water too saline to be used. In both wells this water is also coming from gravel beds beneath the clay. No information was obtained as to the depths to bedrock.

With two exceptions all wells along the road between lots 16 and 20 are of the drilled type. Most of the water encountered is under pressure and rises some distance up the wells. It is, however, frequently saline and cannot then be used for domestic purposes.

The information for most drilled wells along the road is too incomplete to permit a satisfactory explanation to be made for the considerable variations in the mineral content of the ground water. It is suggested that the more saline water is probably coming from bedrock and the better water from sand and gravel beds between the clay and bedrock.

Depths (in feet) of wells along the road are summarized in the following table. Examination of the column for drilled wells indicates that the deeper wells yield the more highly mineralized water:

| | Dug | | Intermittent | Drilled | |
|---|---|---|---|---|---|
| | Sand. | Clay | All in clay | Slightly saline | Very saline |
| Min. | 9 | 11 | 12 | 86 | 70 |
| Max. | 20 | 24 | 20 | 90 | 135 |
| Ave. | 13 | 16 | 16 | 89 | 101 |

ROAD BETWEEN CONCESSION X (OTTAWA FRONT), GLOUCESTER TOWNSHIP, AND OSGOODE TOWNSHIP

This road marks the east part of the boundary between Gloucester and Osgoode townships.

The Carlsbad formation directly underlies all the drift along the road except at the west end where rocks of the Nepean formation have been carried up to bedrock surface along the Gloucester fault, the upward

projection of which crosses the road in lot 19, con. X (O.F.).

The thickness of the overburden varies from about 90 feet along the west and central parts of the road to 43 feet at the east end. This variation is not due to changes in the elevation of the land surface, which is relatively lined along the road, but to a gradual rise in the altitude of the bedrock surface from 161 feet above sea-level in lot 13 to 215 feet in lot 2 at the east end of the road. This is the highest elevation reached by bedrock anywhere in the southeast part of the township and indicates that the wide, shallow, drift-filled valley in the bedrock surface, known to exist throughout much of the east-central part of the township, does not extend into this area. It is believed that more potable waters would be obtained by drilling outside of this part of Gloucester township to the south and east.

Overburden exposed along the road is similar to that along the road to the north between cons. VIII and IX (O.F.). The material consists chiefly of a layer of fine sandy loam overlying marine clay. Most of the shallow, dug wells along the road are between lots 8 and 12, where the road is thickest.

Three drilled wells are known to occur between lots 1 and 5. These wells, all of which are in lot 3, were reported as obtaining excellent supplies of potable ground water from gravel beds beneath the clay. The gravel was described as being 2 to 3 feet thick and to lie on bedrock. One well penetrated about 8 feet of bedrock, and the water is lightly saline to the taste but is sufficiently potable for domestic purposes. Bedrock was not reached in the other two wells. There are no drilled wells along the road between lots 6 and 11, which includes the community of Edwards. The sand beds overlying the clay along this section of the road are relatively thick and sufficient supplies of ground water can be readily obtained from shallow wells dug through the sand to the top of the clay or, if larger reservoirs are desired a short distance into it.

The ground water under the greatest hydrostatic pressures was encountered in the well nearest the Gloucester fault. Farther east, away from the fault, the pressures decrease until finally the static level of the water in the wells is several feet below the surface.

It is believed that the flowing-artesian wells owe their presence chiefly to the Gloucester fault. The slow movement of ground water percolating south and wouthwest down the dip of the bedrock would be arrested by the impervious fault zone resulting in an accumulation of ground water under considerable pressure along the northeast side of the fault. An irregular northeast-facing scarp, which in the south part of the township may reach a height of 100 feet, is believed to occur along the fault and would interrupt the normal movement of the ground water along the surface of the bedrock. This ground water occurs chiefly in gravel beds between the bedrock and the overlying clay but may also be present in the upper few feet of bedrock, which in many places is reported to be partly weathered and gravelly in texture. Gravel lying directly on bedrock is reported to be the principal source of water for the flowing-artesian wells.

Hydrogen sulphide gas is associated with much of the water from wells drilled close to the northeast side of the Gloucester fault. This objectionable gas decreases in quantity farther east but in the same direction the amount of total dissolved solids in the water is reported to increase. In lot 14, for instance, there is little hydrogen sulphide gas but the dissolved mineral content is high.

A summary of the depths (in feet) of the wells along the road is as follows:

| | Dug | | Intermittent | Drilled |
|---|---|---|---|---|
| | Sand | Clay | | |
| Min. | 10 | 13 | 11 | 60 |
| Max. | 24 | 40 | 20 | 157 |
| Ave. | 17 | 19 | 15 | 72 |

Between lots 12 and 17 satisfactory supplies of potable ground water can be obtained with difficulty. The sand covering is extremely thin and wells dug into the drift are chiefly dependent upon the clay for their supply of ground water. The ground water from wells of this type is sufficiently potable for domestic purposes, but the wells can readily be pumped dry and few yield enough ground water to satisfy a farmer's needs. It is believed that the best method of obtaining sufficient ground water in this area is by constructing larger dug wells. This should be done in the late summer when the water-table is normally at its lowest point. Such wells would provide a reservoir of free water for use when shortage might otherwise occur.

Shallow wells dug in the clay along the road are mostly situated near the farmhouse, the deeper, drilled wells being near the barn or in the fields where the water would be more readily available for the stock, the reason being that the ground water from wells drilled into bedrock has too high a mineral content and too frequently gives off a disagreeable odour of hydrogen sulphide gas for drinking. It was reported that even cattle take at least a week to become accustomed to it when they are first brought into the area. The capacity of the drilled wells is, however, large.

Flowing-artesian wells, and wells in which the ground water is under considerable pressure, occur in lots 17, 18, and 19 on the northeast side of the Gloucester fault. These wells are part of a belt that crosses Gloucester and Osgoode townships close to and more or less parallel with the Gloucester fault. The most important is that occurring at the Royal Canadian Navy Establishment in lot 19, con. X (O.F.). This well was drilled 87 feet to the surface of bedrock and at that depth encountered ground water under sufficient hydrostatic pressure to force it 20 feet above the surface and to supply the entire establishment as well as several adjoining houses. The volume of water issuing from adjacent flowing-artesian wells, however, decreased or stopped entirely when this well was drilled. The rate of flow of one well in lot 18, con. IX (O.F.), was measured at 21 g.p.h. on August 10, 1952.

## Community Supplies

The ground-water conditions of all communities in Gloucester township were investigated. The two more important, Cyrville and Orleans, are described in detail below but discussions of the others will be found in the section dealing with the road on which they are situated. Maps showing the location of all wells in Cyrville and Orleans for which information has been obtained and compilation sheets describing most of the wells will be found at the back of this report.

### Community of Cyrville

The area described in this section includes the community of Cyrville, shown on the detailed map at the back of the report, and the built-up areas immediately adjacent in lots 25 and 26, con. I, and lots 26 and 27, con. II (O.F.).

The Billings formation, consisting mainly of dark, almost black shale with a total thickness of about 200 feet, directly underlies the drift throughout the area. The thickness of the drift is rarely greater than 10 feet, and there are numerous outcrops in lot 25, con. I (O.F.).

Marine clay constitutes most of the overburden exposed at the surface. Beneath the clay, and directly overlying bedrock, there is in most places 2 to 3 feet of stony till, the stones being principally formed of rocks of the Billings formation. Exposures of stony till are a good indication that bedrock is close to the surface. Thin layers of sandy loam overlie much of the clay in the southern part of the locality. On this sandy soil several large gardens have been developed whose produce are marketed chiefly in the nearby city of Ottawa.

Water wells in the Cyrville area can be divided into three main types: (1) wells dug just to bedrock surface; (2) wells dug to bedrock surface and then extended into bedrock a few feet by picking or blasting; included in this group are those dug wells with holes drilled in the bottom; (3) drilled wells. These vary greatly in depth, but all derive their ground water supply from the Billings formation. The depths of the dug wells vary from 5 to 35 feet, with an average of approximately 14 feet, and the deeper wells drilled into bedrock are 35 to 175 feet deep, with an average of 82 feet.

At present there is no great shortage of ground water in the Cyrville area. This is surprising when it is remembered that the principal sources of water in the area are clay and shale, both of which are normally considered to be poor aquifers. Geological conditions, too, appear to be unfavourable for large ground-water supplies. Cyrville is on the north limb of a synclinal structure the beds of which have a low, southerly dip. The intake area for the ground water is considered to be entirely local.

One drilled well of unknown depth was reported to be capable of yielding 1,000 gallons an hour. The water from this particular well is used both for domestic purposes and to supply a large garden. A second well, drilled 140 feet into bedrock in lot 27, con. II (O.F.), was reported to be capable of yielding 1,600 gallons an hour. The water is used for irrigating a large garden.

The least satisfactory wells in the area are those that have been dug to bedrock surface. Some of these were reported to be low in the latter part of the summer and autumn, a few having gone completely dry. Such wells are dependent chiefly upon small quantities of ground water soaking along the bedrock surface from some nearby outcrop area, and, in lesser amounts to a lesser degree, to water percolating downward through the overlying marine clay or stony till. They are entirely dependent upon local precipitation and, as they draw from extremely small reservoirs, will go dry quickly in periods of little rainfall.

The quality of the ground water from the Cyrville area is not always satisfactory, although as a whole the water is more potable than in other areas where the aquifers are in the Billings formation. The dissolved mineral content is commonly high and much of the water has a strong odour of hydrogen sulphide gas. Several well owners carry their drinking water daily from the city of Ottawa. These undesirable characteristics are similar to those in other areas in Gloucester township where the ground water is derived from the Billings shale. Ground water percolates extremely slowly through this material and, consequently, dissolves much mineral salt.

A similar situation exists in the stony till above bedrock. This material consists predominantly of boulders and rock fragments of shale embedded in a clayey matrix, all of which could yield considerable mineral

matter to slowly to slowly percolating ground water.

The water from a few wells in the Cyrville area was reported to be cloudy at certain times of the year. This cloudiness is probably caused by fine particles of rock falling into the water from the walls of the well, especially during periods of low atmospheric pressure such as immediately precedes a storm. Temporary cloudiness commonly occurs in water from wells put down in fine-grained rocks such as shale and, except for possible clogging of the water pipes, is not serious. The water from new wells is commonly cloudy for some time after the well has been first drilled. This cloudiness is due to fine rock cuttings disseminated through the water and will usually clear up after the well has been used for a few weeks.

Community of Orleans

The community of Orleans is on Queen's Highway 17, some 9½ miles east of the city of Ottawa, and close to the boundary of Gloucester and Cumberland townships.

The Oxford and Rockcliffe formations directly underlie the drift throughout the community. Rocks of the Ottawa formation outcrop immediately to the north and they are separated from the Oxford and Rockcliffe by a strong east-west trending fault. This fault probably has no effect upon the hydrology of the community.

Overburden consists predominantly of marine clay interbedded with thin lenses of silt and fine sand. These lenses are believed to be the source of much of the ground water obtained by the numerous dug wells within the community.

A steep, north-facing bluff in the clay, believed to have been formed during some higher stage in the history of Ottawa River, parallels the south side of the highway. Wells dug along the base of the bluff are reported to be most satisfactory dug wells in the community. However, the absence of pressure systems for pumping water from these wells suggests that they yield limited supplies of ground water. A similar bluff, but at a lower elevation, extends for a considerable distance along the north edge of the community.

The thickness of overburden gradually decreases easterly across the community. It varies from 113 feet at the west end to 17 feet at the east, with an average of about 41 feet. Elevations of the bedrock surface rise gradually towards the northeast approaching the fault mentioned above. The bedrock surface contains a few minor undulations but they are too small to have much influence on the ground-water supply.

Bored wells, large enough to accommodate tile from 9 to 12 inches in diameter, are common in the community and yield sufficient supplies of ground water for about forty homes. Most wells of this type are bored through the clay until stopped by some obstruction, such as a large boulder or bedrock surface. Adequate supplies of ground water, much of it under considerable hydrostatic pressure, are commonly yielded by the deeper, bored wells. In some localities, the aquifers reported are beds of sand and gravel beneath the clay, in others, the bedrock surface.

Bored wells in the community have proved to yield as satisfactory supplies of water as more expensive, drilled wells. Ground water can only enter a well drilled in unconsolidated material through the open end at the bottom of the casing. If the end of the casing is not in some permeable material the capacity of the well is strictly limited. on the other hand, the joints in the tile lining a bored well are open and provide numerous pores along the whole length of the well for ground water to enter. The depths of wells bored in the community vary from 7 to 113 feet, with an average of 36 feet.

Drilled wells, that is, those constructed with a cable tool machine, are not common in Orleans. Most of them are deeper than the bored type, ranging from 35 to 194 feet deep with an average of 76 feet, and have penetrated to bedrock. The capacity of all drilled wells in Orleans was reported to be large, but except for the well at the Orleans Hotel none is being used at the present time for more than normal domestic purposes.

About 50 per cent of the wells in the community are of the dug type. They range in depth from 6 to 33 feet, with an average of about $12\frac{1}{2}$ feet. The aquifers are chiefly small lenses of silt and fine sand in the clay. Few of these wells are satisfactory. Most of them have been dug by the owners and few are deep enough to ensure an adequate supply of water at all times. During a drought many of them go dry or the water level drops to a point where the well will yield only a limited supply of ground water.

There are four flowing-artesian wells in the northeast part of the community, at the base of a prominent, north-facing bluff. One well was drilled to a depth of 75 feet and the others bored to depths of 69, 52, and 42 feet respectively. The aquifers were reported to be extensive beds of sand and gravel beneath the clay. The rates of flow and temperatures of the water for three of the wells were taken at monthly intervals during the latter part of 1952 and the figures are given in a table at the back of this report. The water is fairly soft, slightly yellowish in colour, and frequently has a faint odour of hydrogen sulphide gas. A fifth well, drilled at the Orleans Hotel, flowed when first completed. The quality of the water was reported to be similar to that of the other flowing-artesian wells.

The aquifers yielding water to the flowing-artesian wells in Orleans are believed to be similar to those tapped by the flowing-artesian wells along Queen's Highway 17, west of the community toward the city of Ottawa. These wells were discussed in the section of this report dealing with the ground water problems along Queen's Highway 17.

Generally, the quality of the ground water in the Orleans area is poor. Many wells of all types were reported to yield ground water containing hydrogen sulphide gas and much of it with a mineral taste and a slightly yellowish colour.

Most of the water is believed to come from bedrock where it is normally contained under considerable pressure by the thick, overlying beds of clay, but can be tapped by deeper drilled or bored wells without difficulty. In some shallow wells small amounts of water have moved upwards through cracks in the clay imparting to it a faint odour of hydrogen sulphide gas. In two instances, the upward movement of ground water under pressure through the clay has formed a spring, much as has happened in the Carlsbad Springs area.

The ground water derived directly from the clay and its associated lenses of silt and fine sand is reported to be hard and clear.

The supplies of ground water in the Orleans area were reported to be adequate for most domestic establishments. Wells reported to go dry or to be low in late summer are generally too shallow and should be deepened. Water is obtained from dug wells either by bailing or by hand suction-type pumps whereas pressure systems are installed in many of the deeper drilled and bored wells.

## DISCUSSION OF ANALYSES

Twelve samples of well waters from Gloucester township were analysed for their mineral content in the laboratory of the Mines Branch, Department of Mines and Technical Surveys, Ottawa. The samples were taken from wells ranging in depth from 12 to 212 feet with aquifers in both drift and bedrock. The samples taken are believed to be representative of the ground water from the more important aquifers. The figures are tabulated at the back of the report.

Samples 2 and 3 are of ground water from wells dug in marine sand overlying clay. The analyses are similar, and indicate the quality of the ground water yielded by most of the wells dug

along the Blackburn Road, the Ridge Road, and other roads situated along the tops of the elongated, sand-covered ridges in the east-central part of the township. The ground water from these two wells has the lowest total dissolved solids of any of the waters sampled. Their chloride and nitrate contents are extremely low. It is evident that potable ground water can be obtained from properly constructed wells dug in the sand. It should be noted that 0.2 p.p.m. of fluorine was reported from the water of the Roman Catholic school (sample 3), and none from that at the Protestant school (sample 2).

Sample 7 is from a well bored 25 feet into marine clay. Its total dissolved solid content of 312.2 p.p.m. is well below the current United States federal standards for drinking water of 500 p.p.m. (1951). Except for the somewhat higher nitrate content, which indicates that some surface water may be entering the wall, the analyses of the water is comparable with that of other water derived from similar material.

Samples 1 and 6 are from drilled walls, 71 and 120 feet deep respectively. These are reported to derive their supplies of ground water from the contact of marine clay and the underlying bedrock. The total dissolved solids contained by the waters from these two wells is fairly high, chiefly due to an increase in the chloride and carbonate content. The chloride content of the 120-foot well was calculated to be 526.8 p.p.m. This is extremely high for drinking purposes and will impart a salty or brackish taste to the water.

The ground water from the 120-foot well contains more dissolved solids than that from the 71-foot well, probably because it has percolated a greater distance through the ground and has been

longer exposed to both overburden and bedrock, and has had a greater opportunity to dissolve more mineral salts.

The 71-foot well is a flowing-artesian well. The intake area is believed to be the high ground to the north and northwest of the well where outcrops are numerous. Only limited supplies of ground water can be obtained from wells drilled into bedrock in this area, which indicates that only a small percentage of the local precipitation actually penetrates the rock. Most of it apparently follows down along the bedrock surface beneath the overburden and can be recovered, some distance away, by wells drilled or bored through the overburden to bedrock.

Samples 11 and 12 are from two deep wells drilled along the Base Line Road south of the community of Ramsayville. The wells were reported to be 165 and 208 feet deep respectively. Ground water under considerable pressure, was encountered by both wells in beds described as 'black gravel' beneath thick beds of marine clay. Large quantities of inflammable gas were reported to have come from the wells when they were first drilled.

Ground water from these wells is distinguished by a high total dissolved solid content, due largely to a high proportion of sodium chloride. It is believed the associated gases and dissolved mineral salts contained in this ground water originated either in the bedrock or was dissolved out of pebbles of Carlsbad shale that constitute a large proportion of the 'black gravel'.

The lack of sulphates in these two samples and in sample 4 indicates that all this water may be from the same aquifer, most probably from 'black gravel'.

Samples 4 and 10 are from two wells, 212 and 86 feet deep respectively, that were reported to derive their ground water supply from the Carlsbad formation. The total dissolved solid content of the water from the deeper well is considerably greater than that from the shallower, indicating that there is less possibility of obtaining potable ground water at depth in these rocks than nearer the surface. The high sodium chloride content of the ground water from the deeper well is similar to that of the water from the 'black gravels', represented by samples 11 and 12.

Sample 3 is of ground water derived from dolomitic limestone of the oxford formation; the total hardness (as $CaCO_3$) of 622.9 p.p.m. and the calculated content of magnesium and sulphate are higher than that of any other water sampled, and compare with analyses of samples of ground water from the Oxford in other parts of the Ottawa-St. Lawrence Lowland.

The fluorine content of the water was determined because of current interest in the relationship of the fluorine content of water to the incidence of dental caries in children. The proportion of fluorine in the ground-water samples analysed ranges from 0 to 1.2 p.p.m. with an average of 0.03 p.p.m. The generally accepted figure deemed to be the most beneficial and least harmful is 1.0 p.p.m.

Summary of Amounts[1] of Dissolved Mineral Matter
in Well Waters from Gloucester Township

| Constituent | Well waters from glacial drift and bedrock (12 samples) | | |
|---|---|---|---|
| | Maximum | Average | Minimum |
| Total dissolved solids | 4217.5 | 1184.7 | 171.7 |
| Silica | 17.0 | 12.3 | 7.3 |
| Fluorine | 1.2 | 0.3 | 0.0 |
| Calcium | 134.7 | 43.7 | 1.8 |
| Magnesium | 69.8 | 28.3 | 0.4 |
| Alkalis (as Na) | 1614 | 211 | 13.3 |
| Sulphate | 248 | 56.0 | 0.0 |
| Chloride | 2056 | 461 | 2.2 |
| Nitrate | 40.0 | 12.7 | trace |
| Bicarbonate | 668.6 | 331 | 100.0 |
| Alkalinity (as $CaCO_3$) | 752.4 | 299 | 82.0 |
| Total hardness | 622.4 | 227 | 6.1 |

[1] In parts per million

## WELL STERILIZATION

The following method is recommended to sterilize a well[2]:

[2] Well Drilling, Technical Manual, T.M 5-295, United States Government Printing Office, Washington, 1943.

mix one heaping tablespoon of chlorinated lime with a little water to make a thin paste, being sure to break up all lumps; stir this paste into 1 quart of water; allow the mixture to stand

a short time and pour off the clear liquid. The chlorine strength of the solution is about 1 per cent: and 1 quart is enough to sterilize 800 imperial gallons of water.

Estimate the volume of water in gallons standing in the well, and for each 800 imperial gallons pour 1 quart of the sterilizing solution into the well. No harm is done if too much solution is used, and it is better to use too much than too little. Agitate the water thoroughly and let it stand for several hours, preferably over night, then flush the well thoroughly to remove all of the sterilizing agent. The sides of the well above the surface of the water can be sterilized by returning the water to the well during the first part of the flushing. Just before completion of the flushing, a sample of the water may be taken if required.

To determine the volume of water in the well, it is necessary to know the diameter of the well and the depth of water in it. With this knowledge, the volume of water present in the well can be easily calculated from the following table and the correct amount of lime solution added.

| Diameter of well (feet) | Number of imperial gallons per foot depth |
|---|---|
| 2.0 | 19.6 |
| 2.5 | 30.6 |
| 3.0 | 44.1 |
| 3.5 | 59.9 |
| 4.0 | 78.3 |
| 4.5 | 99.1 |
| 5.0 | 122.3 |

## CONCLUSIONS

This investigation is believed to warrant the following conclusions:

(1) Except in a few localities, there appears to be enough ground water everywhere in Gloucester township for domestic, stock, and community purposes. There has been a gradual increase in the amount of precipitation in the last 6 years and it is thought that, with the consequent increased recharge, supplies of ground water will continue to be adequate.

(2) Ground water yielded by some aquifers here and there through the township is not sufficiently potable for domestic purposes. In some instances, indeed, the dissolved mineral content, usually in the form of sodium chloride, was so high that the water cannot be used even for watering cattle.

(3) The source of the largest quantities of ground water is beds of sand and gravel lying beneath marine clay and directly on bedrock. This is especially true where these more permeable materials are in some buried stream channel or valley-like structure in the bedrock surface.

(4) The marine clay that occurs at the surface over much of the township is not a good source of ground water. In areas where sufficient supplies of water were reported from the clay, it is probable that much of it is actually coming from lenses of silt and fine sand interbedded with the clay.

(5) In areas where there are approximately 12 or more feet of sand overlying the clay, potable water in quantities sufficient for domestic purposes can be obtained from the base of the sand.

(6) The Nepean and March formations are considered to be excellent sources of hard, clear ground water. These formations are, however, too deep to be important aquifers in Gloucester township.

(7) The Oxford formation is a fair source of ground water, and in most instances can be depended upon to yield sufficient ground water for domestic and farm use.

(8) Sandstone beds in the Rockcliffe formation yield considerable ground water to pumping wells, but in some instances they may be dry and may even absorb water from the well. This, however, is an infrequent occurrence. The quality of the ground water derived from the Rockcliffe formation is generally good, although in the Orleans area some ground water, believed to be coming from the Rockcliffe, has a decided odour of hydrogen sulphide gas.

(9) The Ottawa formation generally yields sufficient ground-water supplies for normal domestic use. In some localities, however, the rock is apparently massive and lacks bedding planes and joint fractures, which are the main aquifers carrying ground water into wells from this type of rock. In such localities, wells in the Ottawa formation are deeper than average.

(10) Ground water from the Carlsbad formation generally contains considerable quantities of dissolved mineral salts, chiefly in the form of sodium chloride, and in some instances it carries so much that it cannot be used for domestic or stock purposes.

(11) Much of the ground water from the Billings formation carries hydrogen sulphide gas and is not a good source of ground water. In the Cyrville area, however, some wells drilled into the Billings are reported to yield large quantities of potable ground water. There is a strong possibility that much of this water is coming from the first few feet of bedrock.

(12) The faults in the township are not believed to be aquifers; rather they form an impermeable barrier to the movement of ground water. Flowing-artesian conditions are thereby created in some areas, such as along the Gloucester fault, and in others the faults may cause a lack of ground water, such as along the west end of the Montreal Road.

(13) There are three distinct areas of flowing-artesian wells in the township, all of which are the result of local geological conditions. One of these is in the Orleans area, north of the Montreal Road; the second is along the Gloucester fault, which cuts across the south-central part of the township; and the third lies between the River Road and the Rideau River about 1 mile southwest of Uplands Airport.

(14) In some parts of Gloucester township the water-table has dropped during the last few decades. Some dug wells on farms along the River Road, which when first constructed yielded sufficient supplies of ground water have had to be deepened by drilling in recent years. It is possible that the shortage of water may have been due to an increased consumption with the installation of pressure systems rather than to the failure of the existing supply.

## Flowing-artesian Wells

Rates of Flow[1] and Ground-water Temperatures[2]

| Year and month | Well No. 1 | | Well No. 2 | | Well No. 3 | | Well No. 4 | | Well No. 5 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Flow | Temp. | Flow | Temp. | Flow | Temp. | Flow | Temp. | Flow | Temp. |
| 1952 | | | | | | | | | | |
| July | 276.8 | | 75.3 | | 1282 | | 387 | | 62.7 | – |
| Aug. | 176.5 | | 46.8 | | 1091 | | 346 | | 35.7 | – |
| Sept. | 150.9 | 47 | 40.2 | 46.5 | 1062 | 47 | 343 | 47 | 61.2 | – |
| Oct. | 132.6 | 47 | 33.6 | 47 | 1059 | 47.5 | 310 | 47 | 69.1 | – |
| Nov. | 105.0 | 48 | 29.7 | 47 | 923 | 48 | 273 | 48 | 76.7 | – |
| Dec. | 100.3 | 48 | 28.8 | 47 | 930 | 48 | 294 | 48 | 83.4 | – |
| 1953 | | | | | | | | | | |
| Jan. | – | – | – | – | – | – | – | – | – | – |
| Feb. | – | – | – | – | – | – | – | – | – | – |
| Mar. | – | – | – | – | – | – | – | – | – | – |
| Apr. | – | – | – | – | – | – | – | – | – | – |
| May | 303 | 48.5 | 83.2 | 48.5 | 1254 | 48 | 373.5 | 48 | – | – |
| June | N.F. | – | 11.1 | – | 494 | 49 | 134.8 | 48.5 | 54.2 | 47.5 |
| July | N.F. | – | 7.8 | – | 486 | 49 | 110.0 | 48.5 | 45.0 | 47.5 |
| Aug. | N.F. | – | N.F. | – | 480 | 49 | 66.2 | 48.5 | 30.6 | 47.5 |
| Sept. | N.F. | – | N.F. | – | 428 | 49 | 22.8 | 49 | 36.4* | 47.5 |
| Oct. | N.F. | – | N.F. | – | 515 | 48 | 198 | 48 | 47 | 47 |
| Nov. | N.F. | – | 7.6 | 48.5 | 569 | 48 | 150.5 | 48 | 39 | 48 |
| Dec. | N.F. | – | 8.0 | 48.5 | 580 | 48 | 175 | 48 | 45 | 48 |

1 In imperial gallons per hour; measurements taken approximately at the first of each month.

2 In degrees fahrenheit.

N.F.: Not flowing.

*: Well had been cleaned out between readings.

DESCRIPTION OF FLOWING-ARTESIAN WELLS MEASURED, GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

| NO. | NAME | LOT | CONC. | TYPE | DEPTH | ELEVATION[1] | AQUIFER |
|---|---|---|---|---|---|---|---|
| 1 | C. Cousineau | 4 | I (O.F.) | Drilled | 194 | 200 | Gravel beneath clay |
| 2 | H. Lalonde | 4 | I (O.F.) | Drilled | 75 | 181 | Gravel beneath clay |
| 3 | Grey Sisters of the Cross | 6 | I (O.F.) | Drilled | | 181(?) | Gravel beneath clay |
| 4 | Hiawatha Park | 6 | I (O.F.) | Drilled | | | Gravel beneath clay |
| 5 | F. Barrett | 16 | IV (R.F.) | Drilled | 20 | 308 | Contact of till and Carlsbad formation |

[1] Elevation in feet above sea-level.

Summary of Wells and Springs Exclusive of Communities

| Wells and springs | Concessions (Ottawa Front) | | | | | | | | | | Totals in Ottawa Front area | Per cent of total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | | |
| Total number | 137 | 173 | 167 | 125 | 42 | 54 | 74 | 55 | 40 | 34 | 901 | 100 |
| Dug | 60 | 117 | 122 | 109 | 34 | 45 | 59 | 50 | 32 | 20 | 648 | 71.92 |
| Bored | 12 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 3.10 |
| Drilled | 64 | 40 | 42 | 11 | 6 | 8 | 10 | 4 | 8 | 2 | 195 | 21.65 |
| Diamond drill-hole | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 12 | 1.31 |
| Dug spring | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0.33 |
| Springs | 1 | 0 | 0 | 5 | 2 | 1 | 5 | 1 | 0 | 0 | 15 | 1.65 |
| Wells: Feet deep | | | | | | | | | | | | |
| 0-20 | 48 | 110 | 116 | 103 | 25 | 41 | 54 | 48 | 32 | 14 | 591 | 65.65 |
| 21-40 | 22 | 19 | 11 | 1 | 4 | 4 | 3 | 2 | 1 | 6 | 73 | 8.1 |
| 41-60 | 5 | 4 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 18 | 1.98 |
| 61-80 | 5 | 10 | 6 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 24 | 2.63 |
| 81-100 | 2 | 5 | 7 | 0 | 0 | 1 | 2 | 1 | 3 | 2 | 23 | 2.54 |
| Over 100 | 49 | 19 | 17 | 7 | 6 | 6 | 6 | 1 | 1 | 6 | 118 | 13.05 |
| Depth unknown | 6 | 6 | 5 | 13 | 7 | 2 | 9 | 3 | 2 | 1 | 52 | 5.77 |

Summary of Wells and Springs Exclusive of Communities

| Wells and Springs | Concessions (Ottawa Front) | | | | | | | | | | Totals in Ottawa Front area | Per cent of total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | | |
| Wells that yield hard water | 76 | 80 | 87 | 58 | 30 | 47 | 48 | 34 | 31 | 24 | 485 | 53.6 |
| medium water | 27 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 6.5 |
| soft water | 14 | 36 | 48 | 55 | 4 | 1 | 10 | 14 | 3 | 3 | 188 | 19.86 |
| salty water | 8 | 1 | 2 | 5 | 5 | 9 | 6 | 3 | 5 | 10 | 54 | 5.98 |
| sulphur water | 7 | 13 | 18 | 2 | 0 | 3 | 2 | 3 | 3 | 7 | 58 | 6.42 |
| mineral water | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0.22 |
| cloudy water | 10 | 12 | 3 | 3 | 0 | 0 | 1 | 3 | 3 | 2 | 37 | 4.1 |
| Wells with aquifer in clay | 51 | 78 | 84 | 25 | 18 | 24 | 25 | 27 | 23 | 18 | 373 | 41.5 |
| in sand | 6 | 37 | 76 | 106 | 17 | 22 | 35 | 38 | 19 | 21 | 377 | 41.8 |
| in gravel | 16 | 3 | 0 | 1 | 2 | 5 | 7 | 1 | 8 | 3 | 46 | 5.15 |
| in till | 10 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 2.42 |
| at overburden - bedrock contact | 5 | 11 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 | 4.1 |
| in bedrock | 46 | 49 | 31 | 2 | 3 | 3 | 4 | 1 | 1 | 8 | 148 | 16.4 |
| aquifer unknown | 2 | 5 | 3 | 1 | 2 | 0 | 4 | 1 | 1 | 1 | 20 | 2.17 |

Summary of Wells and Springs Exclusive of Communities

| Wells and springs | Concessions (Ottawa Front) | | | | | | | | | | Totals in Ottawa Front area | Per cent of Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | | |
| Flowing-artesian wells | 6 | 0 | 1 | 1 | 0 | 2 | 3 | 0 | 0 | 2 | 15 | 1.66 |
| Non-flowing artesian wells | 57 | 40 | 39 | 9 | 6 | 6 | 9 | 4 | 6 | 13 | 189 | 21.0 |
| Non-artesian wells | 72 | 120 | 118 | 100 | 32 | 42 | 58 | 42 | 29 | 16 | 629 | 69.8 |
| Intermittent wells | 1 | 12 | 8 | 10 | 2 | 4 | 2 | 8 | 5 | 3 | 55 | 6.1 |
| Dry holes | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0.11 |
| Not used | 14 | 7 | 13 | 12 | 6 | 13 | 6 | 6 | 2 | 2 | 81 | 89.9 |
| Springs | 1 | 0 | 0 | 5 | 2 | 1 | 5 | 1 | 0 | 0 | 15 | 1.65 |

Summary of Wells and Springs Exclusive of Communities

| Wells and springs | Concessions (Rideau Front) | | | | | | | | Totals in Rideau Front area | Per cent of total |
|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | BF | GORE | | |
| Total number | 46 | 51 | 42 | 115 | 76 | 89 | 39 | 9 | 467 | 100 |
| Dug | 22 | 40 | 27 | 66 | 43 | 57 | 10 | 6 | 271 | 58.03 |
| Bored | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0.21 |
| Drilled | 23 | 11 | 14 | 43 | 29 | 32 | 28 | 2 | 182 | 39.10 |
| Diamond drill-hole | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0.43 |
| Sand point | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 1 | 8 | 1.71 |
| Spring | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0.64 |
| Wells: Feet deep | | | | | | | | | | |
| 0-20 | 13 | 21 | 22 | 54 | 38 | 50 | 5 | 2 | 205 | 43.89 |
| 21-40 | 8 | 9 | 5 | 20 | 10 | 6 | 10 | 4 | 72 | 15.41 |
| 41-60 | 5 | 10 | 5 | 10 | 6 | 1 | 5 | 1 | 43 | 9.21 |
| 61-80 | 6 | 7 | 1 | 5 | 5 | 7 | 12 | 1 | 44 | 9.42 |
| 81-100 | 9 | 0 | 2 | 10 | 4 | 4 | 6 | 0 | 35 | 7.49 |
| Over 100 | 3 | 3 | 6 | 9 | 6 | 14 | 1 | 1 | 43 | 9.21 |
| Depth unknown | 2 | 1 | 1 | 7 | 6 | 7 | 0 | 0 | 24 | 51.39 |

Summary of Wells and Springs, Exclusive of Communities

| | Concessions (Rideau Front) | | | | | | | | Totals in Rideau Front area | Per cent of total |
|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | BF | GORE | | |
| Wells that yield hard water | 45 | 49 | 28 | 93 | 55 | 52 | 34 | 7 | 363 | 77.73 |
| soft water | 1 | 2 | 9 | 15 | 17 | 20 | 2 | 2 | 68 | 14.78 |
| salty water | 1 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 7 | 1.50 |
| sulphur water | 5 | 2 | 3 | 4 | 2 | 5 | 1 | 0 | 22 | 4.71 |
| irony water | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0.43 |
| mineral water | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 4 | 0.86 |
| Wells with aquifer in clay | 17 | 10 | 3 | 5 | 3 | 28 | 10 | 1 | 77 | 16.48 |
| in sand | 5 | 21 | 22 | 44 | 26 | 36 | 2 | 4 | 160 | 34.26 |
| in gravel | 3 | 1 | 4 | 13 | 1 | 12 | 4 | 2 | 41 | 8.78 |
| in till | 5 | 8 | 3 | 26 | 14 | 3 | 0 | 0 | 59 | 12.63 |
| at overburden-bedrock contact | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 |
| in bedrock | 16 | 10 | 7 | 30 | 32 | 16 | 23 | 0 | 136 | 29.12 |
| aquifer unknown | 0 | 1 | 1 | 2 | 0 | 7 | 0 | 0 | 11 | 2.36 |

Summary of Wells and Springs, Exclusive of Communities

| Wells and springs | Concessions (Rideau Front) | | | | | | | | Totals in Rideau Front area | Per cent of total |
|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | BF | GORE | | |
| Flowing artesian | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 6 | 1.28 |
| Non-flowing artesian | 22 | 12 | 12 | 51 | 22 | 32 | 29 | 2 | 182 | 38.97 |
| Non-artesian | 17 | 32 | 26 | 59 | 41 | 49 | 7 | 7 | 239 | 51.20 |
| Intermittent | 4 | 5 | 2 | 4 | 9 | 7 | 2 | 0 | 33 | 7.06 |
| Dry holes | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 4 | 0.86 |
| Not used | 2 | 10 | 1 | 8 | 5 | 6 | 3 | 0 | 35 | 7.50 |
| Springs | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 0.64 |

Summary of Wells and Springs (Communities of Cyrville and Orleans)

| Wells and springs | Cyrville | Orleans | Total number in communities | Per cent of total |
|---|---|---|---|---|
| Total number | 54 | 128 | 182 | 100 |
| Dug | 18 | 73 | 91 | 50 |
| Bored | 0 | 44 | 44 | 24.17 |
| Drilled | 36 | 10 | 46 | 25.27 |
| Springs | 0 | 2 | 2 | 1.10 |

Summary of Wells and Springs (Communities of Cyrville and Orleans)

| Wells and springs | Cyrville | Orleans | Total number in communities | Per cent of total |
|---|---|---|---|---|
| Wells: Feet deep | | | | |
| 0-20 | 11 | 68 | 79 | 43.4 |
| 21-40 | 6 | 24 | 30 | 16.43 |
| 41-60 | 6 | 11 | 17 | 9.34 |
| 61-80 | 10 | 8 | 18 | 9.89 |
| 81-100 | 4 | 1 | 5 | 2.74 |
| Over 100 | 8 | 2 | 10 | 5.48 |
| Depth unknown | 9 | 14 | 23 | 12.63 |
| Wells that yield hard water | 43 | 68 | 111 | 60.99 |
| medium water | 7 | 20 | 27 | 14.83 |
| soft water | 3 | 29 | 32 | 17.58 |
| salty water | 2 | 5 | 7 | 3.84 |
| sulphur water | 8 | 18 | 26 | 14.28 |
| cloudy water | 1 | 15 | 16 | 8.84 |
| irony water | 0 | 1 | 1 | 0.55 |

Summary of Wells and Springs (Communities of Cyrville and Orleans)

| Wells and springs | Cyrville | Orleans | Total number in communities | Per cent of total |
|---|---|---|---|---|
| Wells with aquifer in clay | 0 | 89 | 89 | 48.9 |
| in sand | 0 | 4 | 4 | 2.2 |
| in gravel | 0 | 8 | 8 | 4.5 |
| at overburden-bedrock contact | 10 | 21 | 31 | 17.03 |
| in bedrock | 44 | 4 | 48 | 26.37 |
| aquifer unknown | 0 | 1 | 1 | 0.55 |
| Flowing artesian | 0 | 4 | 4 | 2.2 |
| Non-flowing artesian | 38 | 26 | 64 | 35.16 |
| Non-artesian | 14 | 97 | 111 | 60.99 |
| Intermittent | 4 | 1 | 5 | 2.75 |
| Dry holes | 0 | 0 | 0 | 0.00 |
| Not used | 0 | 6 | 6 | 3.30 |
| Springs | 0 | 1 | 1 | 0.55 |

## REPRESENTATIVE WELL LOGS

The following are logs of representative wells in various parts of Gloucester township. An asterisk has been placed against any formation from which ground water was reported to have been derived.

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 1 | 18 | B.F.(R.F.) | 0 to 77 - clay<br>77 to 82 - gravel*<br>82 to 99 - Oxford |
| 2 | 19 | B.F.(R.F.) | 0 to 76 - clay<br>76 to 90 - March<br>(N.B.) no gravel between clay and March formation* |
| 2 | 21 | B.F.(R.F.) | 0 to 30 - clay<br>30 to 68 - gravel* |
| 2 | 22 | B.F.(R.F.) | 0 to 30 - clay<br>30 to 50 - boulders<br>50 to 100 - Oxford |
| 2A | 30 | B.F.(R.F.) | 0 to 29 - clay<br>29 to 30 - gravel*<br>at 30 - bedrock<br>(N.B.) a flowing-artesian well |
| 3 | 30 | B.F.(R.F.) | 0 to 1 - soil<br>1 to 15 - boulder clay<br>15 to 20 - gravel*<br>20 to 75 - Oxford* |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 2 | 29 | I (R.F.) | 0 to 42 - clay<br>42 to 45 - gravel*<br>at 45 - bedrock |
| 1A | 29 | II (R.F.) | 0 to 10 - clay<br>10 to 16 - sand*<br>at 16 - bedrock |
| 1 | 8 | Gore (R.F.) | 0 to 16 - sand<br>16 to 62 - clay, sand, gravel<br>62 to 250 - Oxford<br>250 to 270 - March<br>270 to 460 - Nepean<br>460 to 490 - Precambrian |
| 4 | 10 | III (R.F.) | 0 to 1 - soil<br>1 to 80 - running sand<br>80 to 95 - gravel*<br>95 to 115 - Oxford* |
| 2 | 30 | III (R.F.) | 0 to 1 - sand<br>1 to 25 - boulders<br>25 to 55 - sand and gravel*<br>55 to 85 - Oxford (?) |
| 8 | 6 | IV (R.F.) | 0 to 5 - sand<br>5 to 50 - clay<br>50 to 80 - running sand*<br>80 to 85 - coarse gravel* |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 6 | 7 | IV (R.F.) | 0 to 32 - sand |
| | | | 32 to 36 - water gravel* |
| | | | 36 to 75 - sand |
| | | | 75 to 77 - water gravel* |
| | | | 77 to 98 - sand |
| | | | 98 to 122 - Carlsbad |
| 1 | 8 | IV (R.F.) | 0 to 10 - gravelly clay |
| | | | 10 to 50 - grey quicksand* |
| | | | at 50 - black gravel* |
| 1 | 9 | IV (R.F.) | 0 to 2 - loam |
| | | | 2 to 30 - clay |
| | | | 30 to 32 - gravel* |
| 5 | 9 | IV (R.F.) | 0 to 10 - sand |
| | | | 10 to 57 - soft sandy clay |
| | | | 57 to 60 - gravel and clay |
| | | | 60 to 68 - silt, clay, gravel |
| | | | 68 to 78 - silt, sand, gravel |
| | | | 78 to 82 - sandy clay |
| | | | 82 to 87 - gravel and clay |
| | | | 87 to 110 - Billings (?) |
| 2A | 15 | IV (R.F.) | 0 to 3 - loam |
| | | | 3 to 22 - blue clay |
| | | | 22 to 35 - fine, grey sand* |
| | | | 35 to 86 - shale |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 5A | 3 | VI (R.F.) | 0 to 6 - sand* |
| | | | 6 to 30 - clay |
| | | | 30 to 40 - clay and boulders |
| | | | at 40 - Carlsbad* |
| 1 | 5 | VI (R.F.) | 0 to 30 - clay |
| | | | 30 to 36 - Carlsbad |
| 1A | 7 | VI (R.F.) | 0 to 75 - clay |
| | | | 75 to 93 - gravel |
| | | | 93 to 150 - Carlsbad |
| 1 | 12 | VI (R.F.) | 0 to 50(?) - clay |
| | | | 50(?) to 157 - gravel* |
| | | | 157 to 209 - Carlsbad |
| 1 | 28 | VI (R.F.) | 0 to 75 - clay |
| | | | 75 to 96 - fine sand |
| | | | 96 to 106 - Carlsbad* |
| 19 (Orleans) | 3 | I (O.F.) | 0 to 73 - clay |
| | | | 73 to 79 - gravel* |
| | | | at 79 - bedrock |
| 52 (Orleans) | 3 | I (O.F.) | 0 to 35 - clay |
| | | | 35 to 40 - gravel* |
| | | | at 40 - bedrock |
| 7 | 6 | I (O.F.) | 0 to 155 - blue clay |
| | | | 155 to 164 - Rockcliffe |
| | | | (N.B.) water from contact of clay and Rockcliffe |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 4 | 10 | I (O.F.) | 0 to 65 - clay |
| | | | 65 to 100 - Hardpan |
| | | | 100 to 250 - Oxford* |
| 1 | 11 | I (O.F.) | 0 to 15 - drift |
| | | | 15 to 140 - Ottawa-St.Martin |
| | | | 140 to 245 - Rockcliffe |
| | | | 245 to 520 - Oxford |
| | | | 520 to 545 - March |
| | | | 545 to 558 - Nepean |
| 6A | 16 | I (O.F.) | 0 to (?) - drift |
| | | | (?) to 160 - Ottawa |
| | | | - St. Martin |
| | | | 160 to 300 - Rockcliffe |
| | | | 300 to 343 - Oxford (?) |
| 8 | 19 | I(O.F.) | 0 to 295 - Ottawa |
| | | | 295 to 306 - Rockcliffe* |
| 9 | 10 | III(O.F.) | 0 to 14 - Sand |
| | | | 14 to 97 - clay |
| | | | 97 to 100 - fine, white sand* |
| | | | 100 to 160 - Billings* |
| 5 | 11 | III(O.F.) | 0 to 85 - clay |
| | | | 85 to 90 - gravel* |
| | | | at 90 - Billings |
| 4 | 14 | III(O.F.) | 0 to (?) - sand |
| | | | (?) to 80 - clay |
| | | | 80 to 85 - gravel |
| | | | (N.B.) no water encountered in this hole |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 1 | 20 | III(O.F.) | 0 to 4 - sandy soil<br>4 to 58 - blue clay<br>58 to 66 - fine sand<br>66 to 120 - Billings |
| 1 | 21 | III(O.F.) | 0 to 3 - sandy loam<br>3 to 38 - blue clay<br>38 to 40 - gravel*<br>40 to 84 - Billings* |
| 1A | 11 | IV (O.F.) | 0 to 5 - sand<br>5 to 180 - clay<br>at 180 - Billings*<br>(N.B.) water also at contact of clay and Billings |
| 5A | 19 | IV (O.F.) | 0 to 10 - red sand<br>10 to 97 - blue clay<br>97 to 212 - Carlsbad (?) |
| 2A | 17 | V (O.F.) | 0 to 180 - clay<br>180 to 200 - Carlsbad* |
| 1B | 19 | VI (O.F.) | 0 to 190 - clay<br>190 to 195 - gravel*<br>195 to 208 - Carlsbad<br>(N.B.) water under considerable pressure |
| 4A | 1 | VII (O.F.) | 0 to 80 - clay<br>80 to 90 - sand and* gravel<br>90 to 100 - Carlsbad<br>(N.B.) water very saline |

| Well number | Lot | Concession | Log (depths in feet) |
|---|---|---|---|
| 1 | 18 | VII (O.F.) | 0 to 204 - overburden, chiefly clay |
| | | | 204 to 469 - Carlsbad |
| | | | 469 to 544 - Billings |
| | | | 544 to 1,044 - Trenton |
| | | | 1,044 to 1,144 - Black River |
| | | | 1,144 to 1,294 - Chazy |
| | | | 1,294 to 1,494 - Beekmantown |
| | | | 1,494 to 1,744 - Nepean |
| 1 | 3 | 10 (O.F.) | 0 to 14 - clay |
| | | | 14 to 16 - sand* |
| | | | 16 to 41 - clay |
| | | | 41 to 43 - gravel* |
| | | | at 43 - Carlsbad |

ANALYSES[1] OF WELL WATERS FROM GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

| | | | | | | | Constituents as Analysed (parts per million) | | | | | | | | | | Hardness (pts. per million) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample number | Owner | Lot | Concession | Depth of well (feet) | Aquifer ✠ | Total dissolved solids (parts per million) | Silica (Col.) ($SiO_2$) | Calcium (Ca) | Magnesium (Mg) | Alkalis (as Na) | Fluoride (F) | Sulphate ($SO_4$) | Chloride (Cl) | Nitrate ($NO_3$) | Bicarbonate ($HCO_3$) | Alkalinity (as $CaCO_3$) | Total hardness (as $CaCO_3$) |
| 1 | M. Sabourin | 1 | 4 OF | 71 | C/B | 448.6 | 14.5 | 14.2 | 11.3 | 145.9 | 1.2 | 47.8 | 67.2 | 1.0 | 284.8 | 242.2 | 81.8 |
| 2 | Protestant School | 10 | 3 OF | 14 | S/C | 171.7 | 9.5 | 20.9 | 1.5 | 19.4 | | 16.4 | 2.4 | 3.0 | 100.0 | 82.0 | 58.3 |
| 3 | R.C. School | 15 | 4 OF | | S/C | 179.2 | 17.8 | 39.1 | 7.0 | 13.3 | 0.2 | 20.6 | 2.2 | 0.5 | 154.5 | 130.6 | 126.4 |
| 4 | C. D. Grey | 19 | 4 OF | 212 | Ca | 3,466.0 | 9.0 | 26.1 | 53.1 | 129.8 | 0.6 | 0.0 | 181.6 | 10.0 | 504.1 | 422.4 | 283.8 |
| 5 | C. Kettles | 17 | 7 OF | 12 | S | 778.4 | 7.3 | 93.3 | 35.5 | 132.8 | 0.5 | 200.0 | 134.4 | 33.0 | 234.2 | 236.0 | 378.7 |
| 6 | L. Landry | 14 | 7 OF | 120 | C/B | 1,252.9 | 15.5 | 80.6 | 58.8 | 316.4 | | 28.8 | 526.8 | 19.0 | 420.2 | 344.4 | 443.2 |
| 7 | R. I. Birtch | 17 | 1 RF | 25 | C | 312.2 | 17.0 | 59.9 | 24.7 | 13.6 | 0.3 | 29.6 | 6.2 | 20.0 | 246.9 | 234.4 | 250.9 |
| 8 | K. Spratt | 26 | 1 RF | 53 | Ox | 762.1 | 13.5 | 134.7 | 69.8 | 27.3 | 0.0 | 248.6 | 60.3 | Trace | 421.6 | 345.6 | 622.9 |
| 9 | F. Barrett | 16 | 4 RF | 20 | ? | 440.7 | 10.3 | 27.1 | 18.4 | 118.4 | 0.7 | 42.8 | 100.9 | Trace | 217.2 | 203.2 | 142.8 |
| 10 | C. H. Brown | 15 | 5 RF | 86 | Ca | 459.9 | 9.5 | 1.8 | 0.4 | 102.1 | | 38.7 | 9.8 | 40.0 | 165.9 | 136.0 | 6.1 |
| 11 | W. N. Ramsay | 9 | 6 RF | 165 | C/G | 1,756.3 | 13.3 | 9.6 | 15.3 | 686.0 | | 0.0 | 747.6 | 6.8 | 548.0 | 462.0 | 87.0 |
| 12 | Rowatt and Payne | 12 | 6 RF | 208 | C/G | 4,217.5 | 10.5 | 16.9 | 50.4 | 1614 | | 0.0 | 2056 | 18.5 | 668.6 | 752.4 | 249.8 |

ANALYSES[1] OF WELL WATERS FROM GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

| | | |
|---|---|---|
| ☆ | C | Clay |
| | S | Sand |
| | G | Gravel |
| | Ca | Carlsbad formation |
| | Ox | Oxford formation |
| | B | Bedrock |

1 Analyses by Mines Branch, Dept. of Mines and Technical Surveys.

Compilation of Well Data

The following abbreviations were used in the accompanying compilation sheets of well data:

Concession: O.F. – Ottawa front
R.F. – Rideau front

Type: Brd. – bored; D. – dug; D.D.H. – diamond drill hole; Drl. – drilled; Spr. – spring; Spt. – sand point.

Depth to Water Surface: M. – measured.

Aquifer: Al. – alluvium; C. – clay; C.T. – clay till; G. – gravel; G.T. – gravelly till; S. – sand; S.T. – sandy till; S.-C.T. – stoney, clay till
(N.B.) Symbols such as S. lc. indicates that the ground water occurs at or near the contact of the two materials.
Ca: – Carlsbad formation; Bi. – Billings formation; Ot. – Ottawa formation; R. – Rockcliffe formation; Ox. – Oxford formation; M. – March formation; N. – Nepean formation; B.R. – bedrock.

Quality: C. – clear; Cl. – cloudy; H. – hard; I. – ironey; M. – medium hard; Min. – mineral taste; S. – soft; Sal. – salty; Sul. – sulphur; * Sample taken for chemical analyses.

Use: B. – baths for medicinal purposes;
D. – domestic; G. – gardening; I. – irrigation;
M. – municipal; N. – not used; S. – stock.

GLOUCESTER TOWNSHIP, CARLETON COUNTY, ONTARIO

| Well No. | Conc. | Lot | Type | Altitude in feet above sea-level | Depth (feet) | Depth to Water Surface (feet) | Depth to Bedrock (feet) | Aquifer | Yield gals. per hour (approx) | Quality | Use | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| 1 | 1 O.F. | 3 | D. | 187 | 17 | 8M | | C. | | M.C. | D. | At house; creek for stock |
| 1 | 1 O.F. | 4 | Drl. | | | +3.0 | | G. | 277 g.p.h. (July 1/52) | H.C. | S. | Flowing well |
| 2 | 1 O.F. | 4 | Brd. | 226 | 25 | 16M | | C. | | M.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 5 | Drl. | 181 | | | | R. | | C.Sal. | D. | Piezometric surface +4.0 feet in spring |
| 2 | 1 O.F. | 5 | D. | 199 | 10 | 3M | | C. | | H.Cl. | N. | |
| 1 | 1 O.F. | 6 | D. | 200 | 15 | 5M | | C. | | H.C. | D. | Low during late summer |
| 1A | 1 O.F. | 6 | D. | 202 | 15 | 6M | | C. | | H.C. | N. | |
| 2 | 1 O.F. | 6 | D. | 204 | 13 | 4M | | C. | | H.C. | D. | Sufficient supply |
| 3 | 1 O.F. | 6 | D. | 196 | 16 | 4M | | C. | | M.C. | D. | Not a good well |
| 4 | 1 O.F. | 6 | D. | 170 | 10 | 3M | | C. | | H.C. | D. | Sufficient supply |
| 5 | 1 O.F. | 6 | Brd. | 170 | 21½ | 2M | | C. | | H.C. | N. | House under construction |
| 6 | 1 O.F. | 6 | Drl. | | | 0 | | C. | 1282 g.p.h. (July 1/52) | S.C. | D. | Flowing well; supplies 6 houses |
| 7 | 1 O.F. | 6 | Drl. | 195 | 164 | 0 | | C./R. | | H.C. | D.S. | Flowing well: |
| 8 | 1 O.F. | 6 | D. | 188 | 13 | 3M | | G. | | M.C. | D. | Water at 180 feet from gravel beneath clay |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8A | 1 O.F. | 6 | Drl. | 187 | 197 | 20 | | G. | | S.C. | D. | Water at 190 feet from gravel beneath clay |
| 9 | 1 O.F. | 6 | Brd. | 185 | 65 | 35 | | S. | | M.Cl. | D. | Water from sand beneath clay |
| 10 | 1 O.F. | 6 | Drl. | | 60+ | +2 | | | 387.1 g.p.h. (July 1/52) | H.C. | D. | Flowing-artesian well |
| 11 | 1 O.F. | 6 | Brd. | | 23 | 2M | | C.(?) | | H.C. | D. | Sufficient for cottage |
| 1 | 1 O.F. | 7 | D. | 192 | 4 | 2M | | C. | | | N. | |
| 2 | 1 O.F. | 7 | Drl. | 202 | 114 | [illegible] | | S.&G. | | Sal.C. | S. | Water from sand and gravel beneath clay |
| 3 | 1 O.F. | 7 | D.(?) | 232 | | | | C.(?) | | S.C. | D. | Flowing-artesian well |
| 1 | 1 O.F. | 8 | Drl. | 217 | 170 | 30 | | R. | | M.Sul. | D.S. | Excellent supply: strong hydrogen sulphide odour |
| 2 | 1 O.F. | 8 | Brd. | 199 | 25 | 5 | | C. | | H.C. | D. | Low during late summer |
| 2A | 1 O.F. | 8 | Drl. | 207 | 133 | 13 | | G. | | H.Sal. | D.S. | Water from gravel beneath clay |
| 1 | 1 O.F. | 9 | D. | 248 | 12 | 4 | | C. | | H.C. | D. | Sufficient supply |
| 2 | 1 O.F. | 9 | Drl. | 245 | 180 | | | R. | | H.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 10 | Drl. | 268 | 212 | | | O.&R. | | H.C. | D.S. | Sufficient supply |
| 2 | 1 O.F. | 10 | Drl. | 287 | 308 | | 5 | O.&R. | | S.Sal. | S. | Sufficient supply |
| 1 | 1 O.F. | 11 | Drl. | | 558 | | 15 | Unknown | | | N. | Insufficient supply: at Vehicle Research Establishment |
| 2 | 1 O.F. | 11 | D. | 266 | 12 | 4M | 4 | T./O. | | H.C. | D. | Low during late summer |
| 2A | 1 O.F. | 11 | Drl. | 249 | 80 | 17 | 80 | O. | | H.Sal. | D.S. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1 O.F. | 11 | Drl. | 244 | 160 | 70 | 8 | O. | | H.C. | D. | Sufficient supply |
| 4 | 1 O.F. | 11 | Drl. | | | | | | | | | Insufficient information |
| 5 | 1 O.F. | 11 | Drl. | | 250 | | 100 | O.(?) | | H.Sal. | N. | At Vehicle Research Establishment |
| 1 | 1 O.F. | 12 | Drl. | 236 | 142 | 30 | 10 | O. | | H.C. | D. | Sufficient supply |
| 2 | 1 O.F. | 12 | Drl. | 254 | 183 | 65 | 10 | O. | | | N. | |
| 3 | 1 O.F. | 12 | Drl. | 232 | 114 | 6 | 0 | O. | | H.C. | D. | Sufficient supply |
| 4 | 1 O.F. | 12 | Brd. | 221 | 7 | .4 | 8 | C./O. | | H.Cl. | D. | Sufficient supply |
| 4A | 1 O.F. | 12 | Brd. | 220 | 9 | | | G. | | H.C. | G. | Sufficient supply |
| 5 | 1 O.F. | 12 | Drl. | 227 | 180 | | | O. | | H.C. | D. | Sufficient supply |
| 6 | 1 O.F. | 12 | D. | 220 | 28 | 15 | | G. | | H.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 13 | D. | 210 | 7 | 1 | | C. | | | | Sufficient supply |
| 1 | 1 O.F. | 15 | D. | 184 | 20 | | 20 | C./R. | | H.C. | D. | Sufficient supply |
| 2 | 1 O.F. | 15 | Brd. | 184 | 27 | 3 | | C. | | S.C. | D. | Sufficient supply |
| 3 | 1 O.F. | 15 | Drl. | 192 | 80 | | | C.? | | H.C. | D. | Insufficient supply |
| 4 | 1 O.F. | 15 | Brd. | 195 | 42 | 16M | | C. | | S.C. | D.G. | Excellent well |
| 5 | 1 O.F. | 15 | D. | 190 | 20 | 9M | | C. | | H. | D. | Sufficient supply |
| 6 | 1 O.F. | 15 | D. | 191 | 18 | 6M | | C. | | H. | D. | Sufficient supply |
| 7 | 1 O.F. | 15 | D. | 207 | 19 | 5M | | C. | | S.C. | D. | Sufficient supply |
| 8 | 1 O.F. | 15 | Drl. | 221 | 355 | 65 | 136 | R.&O. | | H.Sal. | D.S. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 1 O.F. | 15 | D. | 220 | 30 | | 136 | C. | | H. | D. | Sufficient supply |
| 10 | 1 O.F. | 15 | D. | 218 | 24 | | | C. | | H.Cl. | D. | Sufficient supply |
| 11 | 1 O.F. | 15 | D. | 218 | 22 | | | C. | | H.C. | D. | Sufficient supply |
| 12 | 1 O.F. | 15 | D. | 218 | 19 | 4M | | C. | | H.C. | D. | Low in late summer |
| 13 | 1 O.F. | 15 | D. | 217 | 18 | 4M | | C. | | S.C. | D. | Sufficient supply |
| 14 | 1 O.F. | 15 | D. | 217 | 14 | 3 | | C. | | H.Sul. | D. | Low during late summer |
| 1 | 1 O.F. | 16 | D. | 218 | 11 | 4M | | C. | | H.C. | D. | Sufficient supply |
| 2 | 1 O.F. | 16 | Drl. | 223 | 200 | 40 | | G. | | M.Cl. | D.S. | Water from gravel beneath clay |
| 2A | 1 O.F. | 16 | D. | | 25 | | | C. | | H.C. | D. | Sufficient supply |
| 3 | 1 O.F. | 16 | Brd. | 230 | 16 | 4M | | C. | | H.C. | D. | Low in late summer |
| 3A | 1 O.F. | 16 | D. | 230 | 14 | 1M | | C. | | M.C. | D.S. | Sufficient supply |
| 4 | 1 O.F. | 16 | Drl. | 231 | 172 | 40 | None | G. | | S.C. | D. | Sufficient supply |
| 5 | 1 O.F. | 16 | Brd. | 231 | 27 | 1 | | C. | | M.C. | D. | Low in late summer |
| 6 | 1 O.F. | 16 | D. | 240 | 40 | 3 | | C. | | M.C. | D. | Sufficient supply |
| 6A | 1 O.F. | 16 | Drl. | 262 | 343 | 90 | | O.&R. | | H.Sal. | S. | Water too saline for drinking purposes |
| 1 | 1 O.F. | 17 | Drl. | 231 | 237 | 45 | | G. | | S.C. | D. | Water at 175 feet from gravel beneath clay |
| 2 | 1 O.F. | 17 | D. | 234 | 32 | 5 | | C. | | H.C. | D. | Sufficient supply |
| 2A | 1 O.F. | 17 | Drl. | 239 | 220 | 45 | None | G. | | S.Cl. | D. | Water from gravel beneath clay |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1 O.F. | 17 | D. | 235 | 18 | 3 | | C. | | M.C. | D. | Sufficient supply |
| 4 | 1 O.F. | 17 | D. | 236 | 24 | 3 | | C. | | M.C. | D. | Sufficient supply |
| 5 | 1 O.F. | 17 | Drl. | 233 | 287 | | 95 | O. | | Sul.C. | D.S. | Sufficient for tourist camp |
| 6 | 1 O.F. | 17 | D. | 239 | 22 | 4 | | C. | | M.C. | D. | Sufficient supply |
| 7 | 1 O.F. | 17 | D. | 244 | 12 | 5M | | C. | | H.C. | D. | Sufficient supply |
| 8 | 1 O.F. | 17 | D. | 254 | 21 | 9 | | C. | | H.C. | D. | Sufficient supply; at house |
| 8A | 1 O.F. | 17 | Drl. | 263 | 240 | 60 | 105 | O. | | H.Cl. | S. | Sufficient supply |
| 9 | 1 O.F. | 17 | D. | 247 | 18 | | | C. | | H.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 18 | D. | 250 | 15 | 3M | | C. | | H.C. | D. | Sufficient supply |
| 2 | 1 O.F. | 18 | Drl. | | 136 | | | O. | | | | Reported flowing artesian when first drilled |
| 1 | 1 O.F. | 19 | Drl. | 287 | 145 | | 2 | O. | | H.C. | N. | |
| 2 | 1 O.F. | 19 | Drl. | 234 | 136 | 70 | 0 | O. | | H.Cl. | D. | Limited supply |
| 3 | 1 O.F. | 19 | Drl. | 317 | 110 | | 11 | O. | 340 | H.C. | D.G. | Sufficient supply |
| 4 | 1 O.F. | 19 | Drl. | 327 | 158+ | | 1 | O. | | H.C. | D.G. | Sufficient supply |
| 5 | 1 O.F. | 19 | Drl. | 332 | 110 | 75 | 8 | O. | | H.Cl. | D. | Sufficient supply |
| 6 | 1 O.F. | 19 | Drl. | 310 | 178 | 22 | (?) | O. | | H.Cl. | D. | Sufficient supply |
| 7 | 1 O.F. | 19 | Drl. | 349 | 165 | 30 | 1 | O. | | M.C. | D. | Sufficient supply |
| 8 | 1 O.F. | 19 | Drl. | 346 | 308 | | 0 | O.&R. | 450 | H.C. | D.G. | Sufficient supply |
| 9 | 1 O.F. | 19 | Drl. | 349 | 280 | | | O.&R. | | H. | D. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1 O.F. | 19 | D. | 167 | 15 | 3 | | C. | | M.Cl. | D. | Sufficient supply |
| 11 | 1 O.F. | 19 | Brd. | 173 | 30 | | | C. | | M.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 20 | Drl. | 341 | 146 | 4 | | O. | | H.C. | D. | Low in late summer |
| 2 | 1 O.F. | 20 | D. | 331 | 12 | 7M | | C.T. | | H.C. | D. | Sufficient supply |
| 3 | 1 O.F. | 20 | Drl. | 367 | 312 | 60 | 1 | O.&R. | | H.C. | D. | Sufficient supply |
| 4 | 1 O.F. | 20 | D. | 337 | 15 | 7M | | C.T./O. | | | D. | Sufficient supply (?) |
| 5 | 1 O.F. | 20 | Drl. | 348 | 170 | 130(?) | 0 | O. | | H.C. | D. | Sufficient supply |
| 6 | 1 O.F. | 20 | Drl. | 347 | 110 | 25 | 0 | O. | | H.C. | D. | Sufficient supply |
| 7 | 1 O.F. | 20 | Drl. | 344 | 180 | | 0 | O. | | H. | D. | Sufficient supply |
| 8 | 1 O.F. | 20 | Drl. | 344 | 120 | | 0 | O. | | H.C. | D. | Sufficient supply |
| 9 | 1 O.F. | 20 | D. | 322 | 9 | 3M | 11(?) | C.T. | | M. | N. | |
| 10 | 1 O.F. | 20 | Drl. | 325 | 74(?) | 20 | 2 | O. | | H.C. | D.G. | Sufficient supply |
| 11 | 1 O.F. | 20 | Drl. | 344 | 300 | 2M | | O. | | M.C. | N. | |
| 11A | 1 O.F. | 20 | D. | | 9 | 2M | | S.T. | | H.C. | D.S. | Sufficient supply |
| 11B | 1 O.F. | 20 | D. | | 7 | 3M | | S.T.(?) | | | N. | |
| 12 | 1 O.F. | 20 | S. | 299 | | 0 | | G.(?) | | | N. | |
| 12A | 1 O.F. | 20 | D. | | 10 | 4M | | S.T. | | | N. | |
| 13 | 1 O.F. | 20 | D. | 317 | 14 | 3M | | C.T. | | | D. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 1 O.F. | 20 | D. | 325 | 9 | 7M | | C.T. | | H.C. | N. | |
| 14A | 1 O.F. | 20 | Drl. | 326 | 92 | | | O. | | H.C. | D. | Sufficient supply |
| 15 | 1 O.F. | 20 | D. | 332 | 12 | 3M | | C.T. | | | | Information incomplete |
| 16 | 1 O.F. | 20 | Drl. | 336 | 98 | 12 | 2 | O. | | H.C. | D. | Sufficient supply |
| 17 | 1 O.F. | 20 | Drl. | 338 | 100+ | 10M | | O. | | | N. | House under construction |
| 18 | 1 O.F. | 20 | Drl. | 339 | 131 | 18 | | O. | | | N. | House under construction |
| 19 | 1 O.F. | 20 | Drl. | 245 | 126(?) | | | O. | | H.C. | D.G. | Sufficient supply |
| 20 | 1 O.F. | 20 | Drl. | 305 | 48 | 8 | | O. | | H.C. | D. | Excellent well |
| 21 | 1 O.F. | 20 | Drl. | 311 | 125 | 9 | | O. | | M.C. | D. | Sufficient supply |
| 22 | 1 O.F. | 20 | Drl. | 239 | 150 | | 18 | Ox. | | M. | D.G. | Excellent well |
| 23 | 1 O.F. | 20 | Drl. | 184 | 48 | | | C.(?) | | M.C. | D. | Sufficient supply |
| 24 | 1 O.F. | 20 | D. | 178 | 32 | 5 | | C.(?) | | M.C. | D. | Sufficient supply |
| 25 | 1 O.F. | 20 | D. | 176 | 28 | 5 | | C. | | M.C. | D. | Sufficient supply |
| 26 | 1 O.F. | 20 | D. | 171 | 20 | 5M | 20 | C. | | M.C. | D. | Sufficient supply |
| 27 | 1 O.F. | 20 | D. | 173 | 20 | 4M | | C. | | M.C. | D. | Sufficient supply |
| 28 | 1 O.F. | 20 | D. | 163 | 4 | 2 | 20 | C. | | H.C. | D. | Sufficient for several cottages |
| 1 | 1 O.F. | 22 | Drl. | 246 | 125 | | | Bi. | | H.Sul. | D.G. | Sufficient supply |
| 1 | 1 O.F. | 23 | Drl. | 243 | 125 | | | Bi. | | H.Sul. | D.G. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1 O.F. | 23 | D. | 239 | 13 | 8M | | C.T.(?) | | H.C. | D. | Sufficient supply |
| 1 | 1 O.F. | 25 | D. | 234 | 17 | 12 | 17 | G.(?) | | H.C. | D. | Low in the late summer |
| 2 | 1 O.F. | 25 | D. | 234 | 10 | 4 | 10 | C. | | H.C. | D. | Goes dry in late summer |
| 3 | 1 O.F. | 25 | D. | 236 | 30 | | | G.(?) | | H.C. | D. | Low in late summer |
| 4 | 1 O.F. | 25 | Drl. | 233 | 75 | 4M | 2 | G.(?) | | H.C. | D. | Excellent well |
| 5 | 1 O.F. | 25 | Drl. | 234 | 60 | 10 | 1 | Bi. | | Sul.C. | D.G. | Excellent well |
| 6 | 1 O.F. | 25 | D. | 231 | 13 | 4M | 3 | Bi. | | M.C. | D. | Low in late summer |
| 6A | 1 O.F. | 25 | Drl. | 231 | 24 | 3M | | Bi. | | | N. | |
| 7 | 1 O.F. | 25 | D. | 232 | 7 | 3M | | Bi. | | M.C. | D. | Sufficient supply |
| 8 | 1 O.F. | 25 | Drl. | 238 | 81 | 6M | 3 | Bi. | | H.Sul. | D. | Sufficient supply |
| 9 | 1 O.F. | 25 | Drl. | 233 | 160 | | 12 | Bi. | | H.C. | D. | Sufficient supply |
| 10 | 1 O.F. | 25 | D. | 237 | 14 | | 14 | S. | | S.C. | D. | Sufficient for four houses |
| 11 | 1 O.F. | 25 | D. | 237 | 5 | 4M | | S.&G. | | S.C. | N. | Water from sand and gravel beneath clay |
| 12 | 1 O.F. | 25 | D. | 233 | 22 | | 22 | S. | | S.C. | D. | Sufficient supply |
| 1 | 2 O.F. | 1 | D. | 287 | 11 | 7M | | C.T. | | | | Sufficient supply; at barn |
| 2 | 2 O.F. | 1 | D. | 288 | 16 | 9 | | C. | | H.C. | S. | Sufficient supply |
| 2A | 2 O.F. | 1 | D. | 288 | 8 | 5M | | C.T. | | H.C. | D.S. | Goes dry in late summer |
| 1 | 2 O.F. | 2 | D. | 237 | 11 | 5M | | C. | | M.C. | D. | Sufficient supply; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 O.F. | 2 | Drl. | 237 | 85 | | | O. | | H.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 2 | D. | 274 | 11 | 7M | | C. | | H.C. | D. | Sufficient supply; at house |
| 4 | 2 O.F. | 2 | D. | 269 | 11 | 7M | 90 | C. | | H.C. | D. | Sufficient supply; at house |
| 4A | 2 O.F. | 2 | D. | 279 | 17 | 9M | 90 | C. | | M.C. | S. | Sufficient supply |
| 5 | 2 O.F. | 2 | D. | 247 | 10 | 8M | | C. | | S.C. | D. | Limited supply; at house |
| 5A | 2 O.F. | 2 | D. | 254 | 16 | 5M | | C. | | | | Sufficient supply |
| 6 | 2 O.F. | 2 | D. | 256 | 12 | 8M | | C. | | H.C. | D. | Limited supply |
| 7 | 2 O.F. | 2 | B. | 252 | 86 | 3 | 86 | C./O. | | M.C. | D. | Sufficient supply |
| 8 | 2 O.F. | 2 | Brd. | 257 | 80 | 8 | 80 | C. | | S.C. | D. | Sufficient supply |
| 9 | 2 O.F. | 2 | D. | 258 | 10 | 8M | | C.&S. | | M.C. | D. | Sufficient supply; at house |
| 10 | 2 O.F. | 2 | D. | 280 | 14 | 11M | | C.&S. | | H.C. | D. | Sufficient supply |
| 11 | 2 O.F. | 2 | Brd. | 284 | 30 | 7M | | C.&S. | | M.C. | D. | Sufficient supply |
| 12 | 2 O.F. | 2 | Brd. | 282 | 37 | 6M | | C. | | M.C. | D. | Limited supply |
| 13 | 2 O.F. | 2 | D. | 282 | | | | C. | | | D. | Sufficient supply |
| 14 | 2 O.F. | 2 | D. | 282 | 31 | 3 | | C.&S. | | M.C. | D. | Sufficient supply; at house |
| 15 | 2 O.F. | 2 | Brd. | 283 | 35 | 6 | | C.&S. | | H.C. | D. | Sufficient supply; at house |
| 15A | 2 O.F. | 2 | Brd. | 283 | 25 | 10 | | C.&S. | | H.C. | D. | Sufficient supply |
| 16 | 2 O.F. | 2 | D. | 284 | 7 | 5M | | C. | | M.C. | D. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 2 O.F. | 2 | D. | 284 | 20 | 18 | | C. | | H.C. | D. | Sufficient supply |
| 18 | 2 O.F. | 2 | D. | 284 | 12 | 7 | | C.&S. | | H.C. | D. | Sufficient supply |
| 18A | 2 O.F. | 2 | D. | 283 | 10 | 7 | | C.&S. | | H.C. | S. | Sufficient supply |
| 19 | 2 O.F. | 2 | Brd. | 283 | 24 | 10 | | C. | | H.C. | D. | Sufficient supply; at house |
| 19A | 2 O.F. | 2 | D. | 283 | 12 | 9M | | C. | | H.Cl. | N. | |
| 20 | 2 O.F. | 2 | D. | 282 | 11 | 9M | | C. | | M.C. | D. | Sufficient supply; at house |
| 21 | 2 O.F. | 2 | D. | 283 | 11 | 8M | | C. | | H.C. | D. | Low in late summer |
| 22 | 2 O.F. | 2 | D. | 283 | 49 | 5M | | C. | | H.C. | D. | Sufficient supply |
| 23 | 2 O.F. | 2 | D. | 282 | 12 | 9M | | C. | | M.C. | D. | Sufficient supply; at house |
| 24 | 2 O.F. | 2 | D. | 283 | 14 | 4M | | C. | | M.C. | D. | Sufficient supply |
| 25 | 2 O.F. | 2 | Brd. | 288 | 20 | | | C. | | H.C. | D. | Sufficient supply; at house |
| 26 | 2 O.F. | 2 | D. | 290 | 6 | 3M | | C. | | S.C. | D. | Sufficient supply |
| 27 | 2 O.F. | 2 | D. | 291 | 6 | 4M | | C. | | S.C. | D. | Limited supply |
| 28 | 2 O.F. | 2 | Drl. | 292 | 20 | | 20 | C.(?) | | H.C. | D.S. | Sufficient supply |
| 1 | 2 O.F. | 3 | D. | 294 | 12 | 5M | | C. | | H.C. | D.S. | Sufficient supply |
| 1A | 2 O.F. | 3 | D. | 295 | 10 | 5M | | C. | | H.C. | S. | Sufficient supply |
| 2 | 2 O.F. | 3 | D. | 299 | 11 | 8M | 12 | C.&S. | | H.C. | D.S. | Goes dry in late summer |
| 2A | 2 O.F. | 3 | D. | 298 | 9 | 5M | | C. | | | N. | |
| 1 | 2 O.F. | 4 | D. | 295 | 8 | 5M | | C. | | H.C. | D. | Sufficient for school |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 O.F. | 4 | D. | 294 | 11 | 5M | | C. | | H. | D.S. | Sufficient supply |
| 3 | 2 O.F. | 4 | D. | 295 | 10 | 6M | | C. | | H.C. | D. | Sufficient supply |
| 4 | 2 O.F. | 4 | D. | 226 | 10 | 4M | | C. | | H.C. | D.S. | Low in late summer |
| 1 | 2 O.F. | 5 | D. | 293 | 9 | 4M | 9 | C./O. | | H.C. | D. | Seldom used; at house |
| 1A | 2 O.F. | 5 | D. | 291 | 8 | 6M | 8 | C. | | H.C. | S. | Sufficient supply; at barn |
| 1B | 2 O.F. | 5 | D. | 291 | 9 | 3 | 9 | C./O. | 900 | H.C. | N. | In field |
| 2 | 2 O.F. | 5 | Brd. | 250 | 48 | 20M | | C. | | S.C. | D. | Low in late summer |
| 2A | 2 O.F. | 5 | D. | 238 | 12 | 4M | | C.&S. | | S.C. | D. | Low in late summer |
| 3 | 2 O.F. | 5 | D. | 227 | 36 | 4M | | C. | | M.Cl. | D. | Sufficient supply |
| 4 | 2 O.F. | 5 | Brd. | 213 | 28 | 4M | | | | S.C. | | Sufficient supply |
| 5 | 2 O.F. | 5 | D. | 205 | 9 | 2M | | | | Cl. | | |
| 6 | 2 O.F. | 5 | D. | 207 | 25 | 3M | | C. | | Cl. | | |
| 7 | 2 O.F. | 5 | D. | 219 | 11 | 4M | | C.&S. | | S.C. | D.S. | Goes dry during late summer |
| 8 | 2 O.F. | 5 | Drl. | 217 | 190 | 4M | 180(?) | R. | | M.C. | D. | Sufficient supply |
| 9 | 2 O.F. | 5 | D. | 229 | 10 | 3M | | C. | | S.C. | D. | Sufficient supply |
| 10 | 2 O.F. | 5 | D. | 216 | 13 | 3M | | C. | | H.C. | D. | Sufficient supply |
| 1 | 2 O.F. | 6 | D. | 297 | 10 | 9M | 6 | C. | | | D. | Sufficient supply |
| 2 | 2 O.F. | 6 | D. | 289 | 9 | 5M | 9 | C./O. | | H.C. | D.S. | Goes dry |
| 3 | 2 O.F. | 6 | D. | 293 | 8 | 6M | | C. | | | D. | Sufficient supply; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3A | 2 O.F. | 6 | D. | 294 | 9 | 5M | | C. | | | S. | Sufficient supply; at barn |
| 4 | 2 O.F. | 6 | D. | 227 | 10 | 4M | | C. | | | | Limited information |
| 5 | 2 O.F. | 6 | D. | 222 | 13 | 9M | | C. | | H.C. | D. | Low in late summer |
| 6 | 2 O.F. | 6 | D. | 211 | 13 | 6M | 190+ | C. | | H.C. | D. | Sufficient supply; at house |
| 6A | 2 O.F. | 6 | Brd. | 209 | 28 | 1M | 190+ | C. | | H.C. | D. | Low in late summer |
| 6B | 2 O.F. | 6 | D. | 207 | 20 | 3M | | C. | | M.C. | S. | Low in late summer |
| 6C | 2 O.F. | 6 | Drl. | 213 | 192 | 4M | 192 | O. | | M.Cl. | N. | |
| 7 | 2 O.F. | 6 | D. | 211 | 8 | 1M | | C. | | | D. | Sufficient supply |
| 1 | 2 O.F. | 7 | Drl. | 290 | 35 | 0 | 35 | C./O. | | S.C. | D. | Sufficient supply |
| 2 | 2 O.F. | 7 | Drl. | 288 | 40 | | 40 | C./O. | | S.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 7 | D. | 292 | 13 | 5M | | C.&S. | | H.C. | D.S. | Sufficient supply |
| 4 | 2 O.F. | 7 | D. | 235 | 8 | 4M | 100+ | C.&S. | | S. | N. | |
| 5 | 2 O.F. | 7 | D. | 237 | 4 | 1 | | C. | | H.C. | D. | Sufficient supply; at house |
| 5A | 2 O.F. | 7 | Brd. | 252 | 20 | 12 | | C. | | H.C. | D.S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 11 | D. | 270 | 8 | 3M | | C. | | S.C. | N. | |
| 1A | 2 O.F. | 11 | D. | 272 | 15 | 10M | | C. | | H.C. | D. | Sufficient supply |
| 1B | 2 O.F. | 11 | Drl. | 270 | | | 95(?) | O.(?) | | | | Low in early spring |
| 1 | 2 O.F. | 12 | D. | 258 | 13 | 6M | | C. | | S.C. | D.S. | Sufficient supply |
| 2 | 2 O.F. | 12 | Brd. | 259 | 10 | 6 | | C. | | | N. | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 2 O.F. | 12 | Drl. | 261 | 75 | 34M | 50 | O. | | M.C. | D. | Sufficient supply |
| 4 | 2 O.F. | 12 | Brd. | 244 | 26 | 8M | | C. | | S.C. | D. | Sufficient supply |
| 1 | 2 O.F. | 13 | D. | 255 | 17 | 14M | | C.&S. | | C. | D. | Sufficient supply |
| 2 | 2 O.F. | 13 | D. | 255 | 18 | 7M | | C.&S. | | M.C. | D. | Limited supply |
| 3 | 2 O.F. | 13 | D. | 255 | 12 | 5M | | C.&S. | | M.C. | D. | Low in late summer; in house |
| 4 | 2 O.F. | 13 | D. | 239 | 12 | 6M | | C. | | C. | D. | Sufficient supply |
| 1 | 2 O.F. | 14 | D. | 240 | 13 | 5M | | S. | | S.C. | D. | Sufficient supply |
| 2 | 2 O.F. | 14 | D. | 242 | 15 | 3 | | C.&S. | | M.C. | D. | Sufficient supply for school |
| 3 | 2 O.F. | 14 | D. | 242 | 14 | 5M | | C.&S. | | M.C. | D.S. | Sufficient supply |
| 4 | 2 O.F. | 14 | D. | 272 | 14 | 8 | | S. | | M.C. | D. | Sufficient supply; at house |
| 4A | 2 O.F. | 14 | D. | 272 | 10 | 5M | | S. | | M.C. | S. | Low in late summer; at barn |
| 1 | 2 O.F. | 15 | D. | 238 | 7 | 3M | | S. | | | N. | |
| 2 | 2 O.F. | 15 | D. | 243 | 8 | 5M | | S. | | H.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 15 | Spr. | | | | | S. | | | D. | Sufficient supply |
| 4 | 2 O.F. | 15 | D. | 247 | 22 | 0 | | C. | | | N. | In field |
| 1 | 2 O.F. | 16 | D. | 233 | 18 | 6 | | S. | | H.C. | D. | Sufficient supply; at house |
| 1A | 2 O.F. | 16 | Drl. | 231 | 109 | 30 | 109(?) | C./O. | | Sul.C. | S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 17 | D. | 222 | 9 | 6M | | C.&S. | | H.C. | S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 19 | D. | 214 | 32 | 12 | | C. | | H.C. | N. | At house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 2 O.F. | 19 | Drl. | 214 | 332 | 45 | 84 | Bi.(?) | | S.C. | D.S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 21 | Drl. | 263 | 133 | 20 | 35 | Bi. | | M.C. | S. | Sufficient supply; at creek |
| 2 | 2 O.F. | 21 | Drl. | 217 | 103 | 15 | 40 | Bi. | | H.C. | D. | Sufficient for school |
| 3 | 2 O.F. | 21 | Drl. | 268 | 58 | 8M | 17 | Bi. | | S.C. | D.S. | Low in late summer |
| 1 | 2 O.F. | 22 | D. | 260 | | 2M | | S.(?) | | C. | D. | Sufficient supply |
| 2 | 2 O.F. | 22 | Drl. | 218 | 709(?) | 25 | 35 | Bi.(?) | | S.C. | D. | Sufficient supply |
| 2A | 2 O.F. | 22 | D. | 216 | 18 | 6 | | S. | | M.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 22 | D. | 220 | 13 | 9M | | S. | | H.C. | D. | Sufficient supply |
| 3A | 2 O.F. | 22 | Drl. | 220(?) | 105 | 15M | 24 | Bi. | | C.Sul. | D.S. | Sufficient supply |
| 1 | 2 O.F. | 23 | D. | 220 | 9 | 8M | | C.&S. | | H.C. | D. | Sufficient supply |
| 2 | 2 O.F. | 23 | D. | 223 | 10 | 6 | | S. | | H.C. | D. | Sufficient supply; at house |
| 2A | 2 O.F. | 23 | D. | 218 | 8 | 6M | | S. | | H.C. | S. | Sufficient supply; at barn |
| 3 | 2 O.F. | 23 | D. | 212 | 5 | 3 | | C.T. | | S.C. | D. | Sufficient supply |
| 4 | 2 O.F. | 23 | D. | 219 | 8 | 3M | | C.T. | | H.C. | S. | Sufficient supply; in field |
| 5 | 2 O.F. | 23 | D. | 220 | 7 | 3 | | C.T. | | H.C. | D. | Sufficient supply |
| 6 | 2 O.F. | 23 | Drl. | 220 | 105 | | 20 | Bi. | | S.C. | D. | Sufficient supply |
| 7 | 2 O.F. | 23 | D. | 246 | 15 | 8M | | C.T. | | H.C. | D. | Sufficient supply; at house |
| 7A | 2 O.F. | 23 | D. | 235 | 12 | 7M | 12 | C.T./Bi. | | Sul.C. | S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 24 | D. | 226 | 10 | 4M | 10 | S | | H.C. | D | Sufficient supply; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 2 O.F. | 24 | Drl. | 222 | 90 | 16 | 20 | Bi. | | Sul.C. | D.S. | Sufficient supply; at barn |
| 2 | 2 O.F. | 24 | D. | 223 | 12 | 8 | | G.(?) | | H.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 24 | D. | 235 | 8 | 3 | | C.T.(?) | | S.C. | D. | Sufficient supply |
| 4 | 2 O.F. | 24 | D. | 233 | 7 | 3M | | S.&C. | | M.Cl. | D. | Sufficient supply |
| 5 | 2 O.F. | 24 | Drl. | 242 | 105 | | 22(?) | G.(?) | | S.C. | D. | Water at 22 feet in gravel beneath clay |
| 1 | 2 O.F. | 25 | Drl. | 236 | 80 | 20 | 30 | Bi. | | S.C. | D.G. | Sufficient supply |
| 2 | 2 O.F. | 25 | Drl. | 226 | 105 | 25 | 43 | Bi. | | S.C. | D. | Sufficient supply |
| 3 | 2 O.F. | 25 | Drl. | 229 | 140 | 12M | 29(?) | Bi. | | C. | D. | Limited supply |
| 4 | 2 O.F. | 25 | D. | 227 | 22 | 11 | 22 | C.T./Bi. | | C.Sal. | N. | |
| 4A | 2 O.F. | 25 | Drl. | 226 | 72 | 3M | 30 | Bi. | | Sul.C. | D.S. | Sufficient supply; at barn |
| 5 | 2 O.F. | 25 | D. | 227 | 12 | 3 | | S.(?) | | S.C. | D. | Goes dry; at house |
| 6 | 2 O.F. | 25 | D. | 233 | 13 | 4 | | S. | | S.C. | D. | Sufficient supply |
| 7 | 2 O.F. | 25 | D. | 234 | 12 | 9 | | S. | | S.C. | D. | Sufficient supply |
| 8 | 2 O.F. | 25 | D. | 236 | 8 | 6M | | S. | | M.C. | D. | Sufficient supply |
| 9 | 2 O.F. | 25 | D. | 225 | 20 | 6 | | Bi. | | H.C. | D. | Sufficient supply; at house |
| 9A | 2 O.F. | 25 | Drl. | 230 | | | | | | H.C. | S. | Sufficient supply; at barn |
| 1 | 2 O.F. | 26 | D. | 240 | 11 | | 20 | | | S.C. | D. | Limited supply |
| 1A | 2 O.F. | 26 | Drl. | 235 | 60 | | 10 | Bi. | | H.C. | D.S. | Low in late summer |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2 O.F. | 26 | D. | 232 | 11 | 4M | 11 | G. | | H.C. | D.G. | Low in late summer |
| 3 | 2 O.F. | 26 | Drl. | 221 | 64 | | 64(?) | G.(?) | | M.C.Sul. | D. | Sufficient supply; water from gravel beneath clay (?). |
| 4 | 2 O.F. | 26 | Drl. | 228 | 150 | 3 | 7 | Bi. | | S. | D. | Excellent well |
| 1 | 2 O.F. | 27 | D. | 217 | 4 | 3M | 4 | Bi. | | S. | D. | Limited supply |
| 2 | 2 O.F. | 27 | D. | 217 | 9 | 4 | 9 | Bi. | | M.C. | D. | Sufficient for 4 families |
| 3 | 2 O.F. | 27 | Drl. | 221 | 65 | 12M | | Bi. | | S.C. | D. | Sufficient supply |
| 4 | 2 O.F. | 27 | D. | 221 | 8 | 2M | | C.T.(?) | | H.Cl. | D. | Low in late summer |
| 5 | 2 O.F. | 27 | D. | 222 | 12 | 5M | 12 | Bi. | | S.C. | D. | Sufficient supply |
| 6 | 2 O.F. | 27 | Drl. | 224 | 75 | 11M | | Bi. | | M.Cl.Sul. | D. | Sufficient supply |
| 7 | 2 O.F. | 27 | Drl. | 224 | 88 | 16 | 4 | Bi. | | S.C. | D. | Sufficient supply |
| 8 | 2 O.F. | 27 | D. | 226 | 10 | 5M | | Bi. | | H.C. | D. | Sufficient supply |
| 9 | 2 O.F. | 27 | D. | 228 | 16 | 5M | | Bi. | | M.Sul. | D. | Low in late summer |
| 10 | 2 O.F. | 27 | D. | 227 | 10 | 6M | | Bi. | | H.C. | D. | Sufficient supply |
| 10A | 2 O.F. | 27 | Drl. | 227 | 51 | | 4 | Bi. | | H.C.Sul. | N. | |
| 11 | 2 O.F. | 27 | D. | 222 | 8 | 2M | 1 | Bi. | | H.C. | D. | Sufficient supply |
| 12 | 2 O.F. | 27 | D. | 218 | 9 | 3M | 6 | Bi. | | H.Cl. | D. | Sufficient supply |
| 13 | 2 O.F. | 27 | D. | 218 | 6 | 2M | | Bi. | | H.Cl.Sul. | D. | Sufficient supply |
| 14 | 2 O.F. | 27 | D. | 218 | 5 | | 5 | Bi. | | H.Cl.Sul. | | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 2 O.F. | 27 | Drl. | 216 | 80 | | 4 | Bi. | | H.Cl.Sul. | N. | |
| 16 | 2 O.F. | 27 | D. | 221 | 9 | 5M | 4 | Bi. | | C. | D. | Sufficient supply |
| 17 | 2 O.F. | 27 | D. | 221 | 6 | 2M | 4 | Bi. | | H.C. | D. | Sufficient supply |
| 18 | 2 O.F. | 27 | Brd. | 221 | 9 | 4M | | Bi.(?) | | H. | D.G | Sufficient supply |
| 19 | 2 O.F. | 27 | D. | 221 | 14 | 6M | 10 | C./Bi. | | H.C. | D.G. | Sufficient for 2 families |
| 20 | 2 O.F. | 27 | D. | 222 | 14 | | 10 | Bi. | | H.C. | D. | Sufficient supply |
| 21 | 2 O.F. | 27 | Drl. | 226 | 140 | | 8 | Bi. | | S.C.Sul. | D. | Sufficient supply |
| 22 | 2 O.F. | 27 | Drl. | 227 | 140 | 12 | 10 | Bi. | 1600 gal/hr. | M.Sul. | D.G. | Sufficient for irrigation system |
| 22A | 2 O.F. | 27 | D. | 226 | 11 | 5 | 10 | C./Bi. | | H.C. | G. | Sufficient supply |
| 23 | 2 O.F. | 27 | Drl. | 231 | 100+ | | 11 | Bi. | | H.C. | D. | Sufficient supply |
| 24 | 2 O.F. | 27 | D. | 230 | 27 | 12 | 13 | Bi. | | H.C. | D. | Sufficient supply |
| 25 | 2 O.F. | 27 | Drl. | 231 | 103 | 10M | 12 | Bi. | | H.C. | N. | |
| 26 | 2 O.F. | 27 | Drl. | 231 | 86 | 15 | 10 | Bi. | | H.C. | D. | Sufficient supply |
| 27 | 2 O.F. | 27 | Drl. | 231 | 80(?) | | | Bi. | | H.C. | D. | Sufficient supply |
| 28 | 2 O.F. | 27 | D. | 234 | 20(?) | | | C.(?) | | H.C. | D.G. | Low in late summer |
| 29 | 2 O.F. | 27 | D. | 231 | | | | | | H.C. | D. | Used by school |
| 30 | 2 O.F. | 27 | Drl. | 233 | 85 | 25 | | Bi. | | H.C. | D.G. | Sufficient supply |
| 31 | 2 O.F. | 27 | Drl. | 232 | 70 | | | Bi. | | H.C. | D. | Sufficient supply |
| 32 | 2 O.F. | 27 | Drl. | | 80(?) | | | Bi. | | S.C. | D.G. | Sufficient supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 2 O.F. | 27 | D. | 232 | 28 | 8M | | C.(?) | | H.C. | D.G. | Sufficient for irrigation system |
| 1 | 3 O.F. | 1 | D. | 284 | 8 | 6M | | C. | | H.C. | S. | Sufficient |
| 1A | 3 O.F. | 1 | Drl. | 284 | | | | Ot. | | H.C. | D. | Sufficient; at house |
| 1B | 3 O.F. | 1 | D. | 284 | 12 | 5M | | C. | | H.C. | S. | Sufficient; in field |
| 2 | 3 O.F. | 1 | D. | 288 | 11 | 7M | 11 | C.T. | 12+ | H.C. | S. | Water at till/Ottawa contact |
| 2A | 3 O.F. | 1 | D. | 293 | 7 | 6M | | C.T. | | H.C. | D. | Low during late summer |
| 2B | 3 O.F. | 1 | Drl. | 280 | 69 | +1 | 69 | C./Ot. | 29M | H.C. | S. | Flowing well: water from clay/ Ottawa contact |
| 2C | 3 O.F. | 1 | Drl. | 280 | 71 | +1 | 71 | C./Ot. | | H.C. | S. | Flowing well: water from clay/ Ottawa contact |
| 3 | 3 O.F. | 1 | D. | 293 | 8 | 5M | | C. | | H.C. | D. | Sufficient |
| 1 | 3 O.F. | 2 | D. | 296 | 10 | 9M | | C.T. | | H.C. | N. | Extremely hard water; at house |
| 1A | 3 O.F. | 2 | Drl. | 284 | 23 | 9M | 23 | S. | | S.C. | D. | Water from sand between clay and Ottawa |
| 1B | 3 O.F. | 2 | D. | 288 | 14 | 7M | 23 | C. | 10+ | S.C. | S. | Large diameter well |
| 2 | 3 O.F. | 2 | D. | 299 | 10 | 6M | | C. | | H.C. | D. | Sufficient |
| 2A | 3 O.F. | 2 | D. | 303 | 12 | 8M | 12 | C.T. | 10+ | H.C. | S. | Sufficient |
| 2B | 3 O.F. | 2 | Drl. | 291 | 14+ | 1M | | C. | | C.Sul. | S. | Sufficient |
| 2C | 3 O.F. | 2 | D. | 291 | 9 | 4M | | C. | | H.C. | S. | Sufficient |
| 1 | 3 O.F. | 3 | Drl. | 305 | 60 | | 20 | Ot. | | H.C. | N. | At house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 3 O.F. | 3 | D. | 301 | 12 | 9 | 12 | S. | 6+ | H.C. | D.S. | Water from sand between clay and Ottawa |
| 2 | 3 O.F. | 3 | Drl. | 306 | 68 | 11 | 1 | Ot. | 10+ | H.C. | D.S. | Water supply decreasing annually |
| 2A | 3 O.F. | 3 | D. | 206 | 13 | 6M | | C. | | H.C. | D. | Sufficient for 2 families; at road |
| 1 | 3 O.F. | 4 | Drl. | 301 | 70 | | 0 | Ot. | 13+ | H.C. | D.S. | Never dry |
| 1A | 3 O.F. | 4 | D. | 301 | 15 | 7 | 0 | C. | | H.C. | S. | Sufficient; in field |
| 2 | 3 O.F. | 4 | D. | 307 | 8 | 7 | 3 | Ot. | | H.C. | D.S. | Limited supply |
| 2A | 3 O.F. | 4 | D. | 296 | 8 | 4 | 4 | Ot. | 5+ | H.C. | S. | Never dry; in field |
| 3 | 3 O.F. | 4 | D. | 294 | 12 | 6M | | C. | 10+ | H.C. | D.S. | Never dry |
| 3A | 3 O.F. | 4 | D. | 293 | 7 | 6M | | C. | | | N.(?) | |
| 4 | 3 O.F. | 4 | D. | 287 | 9 | 7M | | S.&C. | | S.C. | D.S. | Never dry |
| 1 | 3 O.F. | 5 | D. | 297 | 11 | 8M | 2 | C. | | H.C. | D. | Goes dry |
| 1A | 3 O.F. | 5 | D. | 289 | 12 | 8 | 4 | Ot. | 15+ | S.C. | D.S. | Never dry |
| 2 | 3 O.F. | 5 | D. | 293 | 8 | 6M | 8 | C. | | H.C. | D. | Never dry |
| 3 | 3 O.F. | 5 | D. | 287 | 10 | 6M | | S.&C. | | H.C. | D. | Sufficient; at house |
| 4 | 3 O.F. | 5 | D. | 273 | 7 | 4M | | S.&C. | | S.C. | D. | Sufficient |
| 5 | 3 O.F. | 5 | Drl. | 268 | | | | S.&C. | | S.C. | D.S. | Sufficient |
| 6 | 3 O.F. | 5 | D. | 279 | 7 | 6M | | S./C. | | H.C. | D. | Sufficient |
| 7 | 3 O.F. | 5 | D. | 281 | 8 | 5M | | S. | | H.C. | D. | Never dry |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | 3 O.F. | 5 | D. | 283 | 8 | 6M | | S. | | S.C. | D. | Never dry |
| 1 | 3 O.F. | 6 | D. | 293 | 9 | 7M | 9 | C. | | H.C. | D. | Limited supply |
| 2 | 3 O.F. | 6 | D. | 295 | 12 | 7M | | C. | | H.C. | D. | Low during late summer |
| 2A | 3 O.F. | 6 | D. | 295 | 11 | 7M | | C. | | H.C. | S. | Sufficient; at barn |
| 2B | 3 O.F. | 6 | D. | 290 | 12 | 6 | | C. | | H.C. | S. | Low during late summer; in field |
| 2C | 3 O.F. | 6 | D. | 290 | 16 | 10 | | C. | | H.C. | S. | Low during late summer; in field |
| 3 | 3 O.F. | 6 | D. | 291 | 16 | 6M | | C. | | H.C. | D.S. | Never dry |
| 3A | 3 O.F. | 6 | D. | 281 | 8 | 7 | | C. | | H.C. | S. | Never dry; in field |
| 4 | 3 O.F. | 6 | D. | 286 | 11 | 6M | | S.&C. | 6+ | H.C. | S. | Sufficient; in field |
| 1 | 3 O.F. | 7 | D. | 288 | 16 | 11M | | C. | 5+ | H.C. | D.S. | Never dry |
| 2 | 3 O.F. | 7 | D. | 275 | 17 | 10M | | S.&C. | | | N. | At abandoned house |
| 2A | 3 O.F. | 7 | Drl. | 272 | | | | | | | S. | Information incomplete |
| 3 | 3 O.F. | 7 | D. | 272 | 17 | 8M | | S.&C. | | H.C. | D.S. | Sufficient |
| 4 | 3 O.F. | 7 | D. | 283 | 14 | 6 | | S./C. | | H.C. | D. | Sufficient; at house |
| 4A | 3 O.F. | 7 | D. | 281 | 14 | 5M | | S.&C. | 12+ | S.C. | S. | Sufficient; at barn |
| 5 | 3 O.F. | 7 | D. | 280 | 10 | 6M | | S.&C. | | H.C. | D. | Sufficient |
| 1 | 3 O.F. | 8 | D. | 285 | 29 | 4 | | S.&C. | | S.C. | D.S. | Never dry |
| 2 | 3 O.F. | 8 | D. | 282 | 11 | 9M | | S./C. | | H.C. | D. | Sufficient(?) Water at 6 feet from sand/clay contact; at house |
| 3 | 3 O.F. | 8 | D. | 278 | 12 | 7M | | S.&C. | | H.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3A | 3 O.F. | 8 | Drl. | 275 | 95 | 25 | | Bi. | 25+ | Cl.Sul. | S. | Never dry |
| 4 | 3 O.F. | 8 | D. | 279 | 9 | 8M | | S.&C. | | H.C. | D. | Sufficient |
| 5 | 3 O.F. | 8 | D. | 273 | 9 | 6M | | S.&C. | | H.C. | D. | Sufficient |
| 1 | 3 O.F. | 9 | D. | 271 | 15 | 7 | | S.&C. | | H.C. | D. | Sufficient; at house |
| 1A | 3 O.F. | 9 | Drl. | 272 | 150 | 25 | 50 | Bi. | 25+ | C.Sul. | S. | Sufficient; at barn |
| 2 | 3 O.F. | 9 | D. | 278 | 15 | 8 | | S.&C. | | H.C. | D. | Sufficient; at house |
| 2A | 3 O.F. | 9 | Drl. | 272 | 150 | 30 | 60 | Bi. | 27+ | C.Sul. | S. | Sufficient; at barn |
| 1 | 3 O.F. | 10 | D. | 272 | 17 | 10M | | S.&C. | 12+ | H.C. | D.S. | Sufficient |
| 2 | 3 O.F. | 10 | D. | 270 | 15 | 8M | | S.&C. | | H.C. | D.S. | Sufficient |
| 3 | 3 O.F. | 10 | Drl. | 270 | 160 | 60M | 118 | Bi. | 20+ | C.Sul. | D. | Sufficient |
| 4 | 3 O.F. | 10 | Drl. | 271 | 160 | 60M | 118 | Bi. | 20+ | C.Sul. | D. | Sufficient |
| 5 | 3 O.F. | 10 | Drl. | 273 | 165 | 50 | 118 | Bi. | 12+ | C.Sul. | D. | Sufficient |
| 6 | 3 O.F. | 10 | D. | | 10 | 9 | | S. | | H.C.* | D. | Not sufficient supply for school 52° F |
| 7 | 3 O.F. | 10 | Drl. | 271 | 173 | 60M | 118 | Bi. | 30+ | C.Sul. | D. | Sufficient |
| 8 | 3 O.F. | 10 | Drl. | 272 | 173 | 60 | 118 | Bi. | | C.Sul. | D. | Sufficient |
| 9 | 3 O.F. | 10 | Drl. | 270 | 160 | 60 | 118 | Bi. | 120+ | C.Sul. | D. | Sufficient |
| 10 | 3 O.F. | 10 | D. | 272 | 16 | 11M | | S.&C. | | H.C. | D. | Sufficient |
| 1 | 3 O.F. | 11 | D. | 272 | 9 | 1 | | S.&C. | 20+ | S.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 3 O.F. | 11 | Drl. | 270 | 180 | 35 | 85 | Bi. | | H.C. | S. | Sufficient |
| 2 | 3 O.F. | 11 | D. | 273 | 20 | 10 | | C. | | S.C. | D. | Sufficient |
| 3 | 3 O.F. | 11 | D. | 266 | 19 | 10M | | S.&C. | | S.C. | D. | Sufficient |
| 4 | 3 O.F. | 11 | D. | 224 | 10 | 8 | | S.&C. | | S.Cl. | D. | Sufficient |
| 5 | 3 O.F. | 11 | Drl. | 219 | 90 | 0 | 90 | G./Bi. | | C.Sal. | D.(?) | Water at 89 feet in gravel over Billings |
| 6 | 3 O.F. | 11 | Drl. | 223 | | | | | | S.C.Sul | D.S. | Never dry; information incomplete |
| 7 | 3 O.F. | 11 | D. | 223 | 13 | 5 | | C. | | S.C. | D. | Goes dry |
| 8 | 3 O.F. | 11 | Drl. | 221 | 48 | 5 | 90 | S.&C. | | H.C. | D. | Never dry |
| 8A | 3 O.F. | 11 | Drl. | 222 | 90 | 10 | 90 | Bi(?) | | H.C. | S. | Water from drift/Bi. contact |
| 9 | 3 O.F. | 11 | D. | 223 | 12 | | 95 | S.&C. | | H.C. | D. | Dry when measured |
| 9A | 3 O.F. | 11 | D. | 223 | 8 | 6 | | S.&C. | | H.C. | S. | Goes dry |
| 1 | 3 O.F. | 12 | Drl. | 244 | 48 | 22M | | C.(?) | 18+ | H.C. | D.S. | Sufficient |
| 2 | 3 O.F. | 12 | D. | 243 | 24 | 6M | | C.(?) | | H.C. | D. | Water from clay beneath sand (?) |
| 3 | 3 O.F. | 12 | D. | 243 | 10 | 5M | | S.&C. | | H.C. | S. | Sufficient |
| 4 | 3 O.F. | 12 | D. | 241 | 15 | 4M | | S.&C. | | | N. | |
| 5 | 3 O.F. | 12 | D. | 222 | 16 | 2 | | S.&C. | | | N. | Never dry |
| 5A | 3 O.F. | 12 | Drl. | 221 | 100 | | 93 | Bi. | | S.C. | D. | Water at 100 feet in Billings |
| 6 | 3 O.F. | 12 | Drl. | 222 | 85 | 2 | 85 | C.(?) | | S.C. | D. | Water at 85 feet from clay/ Billings contact |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 O.F. | 12 | Drl. | 220 | 80 | 5M | None | S.&C. | | S.C. | D. | Never dry |
| 7A | 3 O.F. | 12 | Drl. | 220 | 80 | 20 | None | S.&C. | | S.C. | D. | |
| 8 | 3 O.F. | 12 | D. | 219 | 11 | 4 | | C. | | H.C. | D. | Never dry; near a creek |
| 9 | 3 O.F. | 12 | D. | 225 | 12 | | | C. | | H.C. | D. | Sufficient; at house |
| 9A | 3 O.F. | 12 | D. | 226 | 13 | 4M | | S. | | H.C. | S. | Never dry; at barn |
| 1 | 3 O.F. | 13 | Drl. | 243 | 106 | 30 | 100 | Bi. | | Cl.Sul. | S. | Sufficient |
| 2 | 3 O.F. | 13 | D. | 242 | 8 | 5M | | S.&C. | | H.C. | D. | Not a sufficient supply |
| 3 | 3 O.F. | 13 | D. | 216 | 11 | 8M | | C. | | H.C. | D. | Never dry |
| 4 | 3 O.F. | 13 | D. | 213 | 24 | 12 | | S.&C. | | S.C. | D. | Never dry |
| 5 | 3 O.F. | 13 | D. | 221 | 12 | | | C. | | S.C. | D. | Never dry |
| 6 | 3 O.F. | 13 | D. | 221 | 13 | 6 | | S.(?) | | H.C. | D. | Low in late summer |
| 7 | 3 O.F. | 13 | D. | 221 | 12 | 5M | | S. | | H.C. | D. | Low in late summer; at house |
| 7A | 3 O.F. | 13 | D. | 225 | 25 | | | S. | | H.C. | N. | Never dry |
| 8 | 3 O.F. | 13 | Drl. | | 97(?) | | | Bi. | | | | Sufficient for school |
| 1 | 3 O.F. | 14 | Drl. | 246 | 157 | 8 | 110 | Bi. | | Sul. | S. | Sufficient for slaughter house; 110 feet of clay to bedrock |
| 2 | 3 O.F. | 14 | D. | 243 | 9 | 3 | | S./C. | | S.C. | D.S. | Water at 5 feet from sand/clay contact |
| 3 | 3 O.F. | 14 | D. | 245 | 9 | 6M | | S. | | S.C. | D. | Sufficient; no clay in well |
| 4 | 3 O.F. | 14 | D. | 219 | 15 | 5M | | C. | | S.C. | D. | Low in late summer |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4A | 3 O.F. | 14 | D. | 217 | 14 | 5 | | C. | | S.C. | N. | |
| 5 | 3 O.F. | 14 | D. | 222 | 12 | 2M | | S.&C. | | H.C. | D. | Never dry |
| 6 | 3 O.F. | 14 | D. | 222 | 13 | 3M | | S.&C. | | S.C. | D. | Never dry |
| 7 | 3 O.F. | 14 | D. | 223 | 9 | 6 | | S.&C. | | S.C. | D. | Goes dry during late summer |
| 7A | 3 O.F. | 14 | D. | 220 | 9 | 6 | | S.&C. | | H.C. | D. | Sufficient; at barn |
| 8 | 3 O.F. | 14 | D. | 224 | 12 | 7 | | S.&C. | | H.C. | D. | Never dry |
| 9 | 3 O.F. | 14 | D. | 224 | 10 | 5 | | S.&C. | | S.C. | D. | Never dry |
| 10 | 3 O.F. | 14 | D. | 229 | 9 | 6M | | S. | | S.C. | D. | Never dry; no clay in well |
| 11 | 3 O.F. | 14 | D. | 228 | 10 | 5 | | S. | | S.C. | D. | Never dry; no clay in well |
| 12 | 3 O.F. | 14 | D. | 224 | | | | S.&C. | | S.C. | D. | Goes dry during late summer |
| 13 | 3 O.F. | 14 | D. | 228 | 12 | 7 | | S.&C. | | S.C. | D. | Never dry |
| 13A | 3 O.F. | 14 | D. | 228 | 16 | 14 | | S.&C. | | H.C. | D. | Never dry |
| 13B | 3 O.F. | 14 | D. | 228 | 8 | 5 | | S.&C. | | S.C. | S. | Never dry |
| 13C | 3 O.F. | 14 | D. | 229 | 7 | 4 | | S.&C. | | S.C. | S. | Never dry |
| 1 | 3 O.F. | 15 | Spt. | 238 | 11 | | | S. | | S.C. | D. | Sufficient |
| 2 | 3 O.F. | 15 | Spt. | 239 | 6 | | | S. | | S.C. | D. | Sufficient; in house |
| 3 | 3 O.F. | 15 | D. | 236 | 9 | 3 | | S. | | S. | D. | Sufficient; in house |
| 4 | 3 O.F. | 15 | Drl. | 243 | 230(?) | | 100 | Bi. | | C.Sul. | D. | Sufficient |
| 5 | 3 O.F. | 15 | D. | 234 | 6 | 2 | | S. | | H.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | 3 O.F. | 15 | D. | 233 | 6 | 2M | | S.&C. | | H.C. | D.S. | Sufficient |
| 7 | 3 O.F. | 15 | D. | 229 | 9 | 3 | | S.&C. | | | N. | House under construction |
| 8 | 3 O.F. | 15 | D. | 229 | 40 | 5 | | S.&C. | | S.C. | D. | Never dry |
| 8A | 3 O.F. | 15 | D. | 227 | 35 | 5 | | S.&C. | | S.C. | N. | Never dry |
| 8B | 3 O.F. | 15 | D. | 226 | 35 | 0 | | S.&C. | 5+ | S.C. | S. | Never dry |
| 9 | 3 O.F. | 15 | D. | 227 | 12 | | | S.&C. | | S.C. | N. | Never dry |
| 9A | 3 O.F. | 15 | D. | 228 | 8 | 5 | | S.&C. | | S.C. | D. | Never dry |
| 10 | 3 O.F. | 15 | D. | 227 | 10 | 8 | | S.&C. | | | N.(?) | |
| 11 | 3 O.F. | 15 | D. | 226 | 15 | 5 | | S./C. | | H.C. | D. | Takes one day to fill after pumped dry |
| 1 | 3 O.F. | 16 | D. | 230 | 12 | 5M | | S. | | S.C. | D. | Sufficient |
| 2 | 3 O.F. | 16 | D. | 228 | 15 | 7M | | S. | | H.C. | D. | Sufficient |
| 3 | 3 O.F. | 16 | D. | 226 | 10 | 10M | | S.&G. | | S.C. | D. | Sufficient |
| 4 | 3 O.F. | 16 | Brd. | 228 | 26 | 12M | | S./C. | | H.C. | D. | Sufficient |
| 5 | 3 O.F. | 16 | D. | 222 | 11 | 5M | | S./C. | | H.C. | D. | Sufficient |
| 6 | 3 O.F. | 16 | D. | 223 | 13 | 5M | | S.&C. | | H.C. | D. | Sufficient |
| 7 | 3 O.F. | 16 | D. | 222 | 8 | 3M | | C. | | H.C. | D. | Goes dry |
| 8 | 3 O.F. | 16 | D. | 232 | 12 | 3M | | S.&C. | | H.C. | D.S. | Sufficient |
| 9 | 3 O.F. | 16 | D. | 225 | 4 | 4 | | S. | | S.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 3 O.F. | 16 | D. | 230 | 8 | 4M | | S./C. | | H.C. | D. | Sufficient |
| 11 | 3 O.F. | 16 | D. | 233 | 10 | 6 | | S. | | S.C. | D.G. | Sufficient |
| 12 | 3 O.F. | 16 | D. | 234 | 11 | 6M | | S./C. | | H.C. | D. | Sufficient |
| 13 | 3 O.F. | 16 | D. | 230 | 12 | 7 | | S./C. | | S.C. | D. | Sufficient |
| 14 | 3 O.F. | 16 | D. | 226 | 4 | 1M | | S. | | H.C. | D. | Sufficient; in house; clay at 10 feet |
| 15 | 3 O.F. | 16 | D. | 232 | 10 | 8M | | S./C. | | | N. | Vacant house |
| 1 | 3 O.F. | 17 | D. | 222 | 6 | | | | | | | Dry well; not deep enough |
| 2 | 3 O.F. | 17 | D. | 221 | 8 | 5M | | S./C. | | H.C. | D. | Sufficient |
| 3 | 3 O.F. | 17 | D. | 223 | 11 | 6M | | S./C. | | H.C. | D. | Sufficient; at house |
| 3A | 3 O.F. | 17 | D. | 223 | 7 | 4M | | S./C. | 10+ | H.C. | S. | Sufficient; at barn |
| 4 | 3 O.F. | 17 | D. | 253 | 12 | 10M | | S./C. | | H.C. | D. | Water at 10 feet from sand/clay contact |
| 1 | 3 O.F. | 18 | D. | 220 | 17 | 9M | | S./C. | | | N. | At house |
| 1A | 3 O.F. | 18 | D. | 220 | 13 | 6M | | S./C. | 15+ | H.C. | S. | Sufficient; at barn |
| 2 | 3 O.F. | 18 | D. | 218 | 25 | 7M | | S./C. | | H.C. | D. | Sufficient |
| 2A | 3 O.F. | 18 | Drl. | 219 | 156 | 40 | 100 | Bi.(?) | | C.Sal. | S. | Sufficient |
| 1 | 3 O.F. | 19 | Drl. | 217 | 98 | 25 | 35 | Bi. | 27+ | S.Sul. | D.S. | Sufficient |
| 1 | 3 O.F. | 20 | Drl. | 216 | 120 | 8(?) | 80 | Bi. | 55+ | S.C. | D.S. | Water at 120 feet from Billings |
| 1 | 3 O.F. | 21 | Drl. | 217 | 110 | 15M | 40 | Bi. | | S.C. | D. | Water at 84 feet from Billings |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 3 O.F. | 21 | Drl. | 216 | 47 | 40 | 40 | Bi.(?) | 31+ | S.C. | D.S. | Sufficient |
| 1 | 3 O.F. | 22 | Drl. | 220 | 165 | 140 | 18 | Bi. | | Cl.Sul. | N. | At house |
| 1A | 3 O.F. | 22 | Drl. | 214 | 42 | 11 | 18 | Bi.(?) | 8+ | C.Sul. | D.S. | Sufficient; at barn |
| 2 | 3 O.F. | 22 | Drl. | 225 | 105 | 10M | 40 | Bi. | 20+ | C.Sul. | D.S. | Sufficient |
| 1 | 3 O.F. | 24 | Drl. | 215 | 33 | 10 | 20 | Bi. | | H.C. | D. | Sufficient; creek for stock |
| 1 | 4 O.F. | 1 | Drl. | 281 | 105 | 85 | | C.(?) | | H.Sal. | S. | Water may be from clay/ Ottawa contact |
| 2 | 4 O.F. | 1 | Drl. | 281 | 71 | +1M | 50 | C. | 220M | H.C.* | S. | Water at 50 feet from clay/ Ottawa contact 47° F |
| 3 | 4 O.F. | 1 | D. | 276 | 11 | 5M | | S./C. | | H.C. | D. | Water at 5 feet from sand/clay contact |
| 4 | 4 O.F. | 1 | D. | 279 | | | | S./C. | | H.C. | D. | Goes dry; at store |
| 5 | 4 O.F. | 1 | D. | 262 | | | | C. | | H.C. | D.S. | Sufficient |
| 5A | 4 O.F. | 1 | D. | 262 | | | | C. | | H.C. | D. | Sufficient |
| 6 | 4 O.F. | 1 | D. | 280 | 18 | 6M | | S.&C. | | S.C. | D. | Excellent supply |
| 7 | 4 O.F. | 1 | D. | 284 | 8 | 5M | | S./C. | | S.Cl. | D. | Low during late summer |
| 8 | 4 O.F. | 1 | D. | 278 | | | | S. | | H.C. | D.S. | Sufficient |
| 9 | 4 O.F. | 1 | D. | 277 | | | | S.&C. | | S.C. | D. | Never dry; in house |
| 10 | 4 O.F. | 1 | D. | 278 | 9 | 4M | | S./C. | | S.C. | D. | Well is bottomed on clay |
| 11 | 4 O.F. | 1 | D. | 271 | 7 | 3M | | S./C. | | S.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11A | 4 O.F. | 1 | D. | 281 | 10 | 6M | | C. | | | N. | |
| 1 | 4 O.F. | 2 | D. | 284 | 10 | 6M | | S./C. | | H.C. | D. | Water at 9 feet from sand/clay contact |
| 2 | 4 O.F. | 2 | D. | 283 | 10 | 5M | | S. | | H.C. | D. | water from coarse sand |
| 2A | 4 O.F. | 2 | D. | 282 | 10 | 6M | | S. | | H.C. | D.S. | Never dry |
| 3 | 4 O.F. | 2 | D. | 281 | 9 | 5M | | S./C. | | H.C. | D. | Water at 6 feet from sand/clay contact |
| 3A | 4 O.F. | 2 | D. | 282 | 9 | 6M | | S./C. | | S.C. | D. | Water at 5 feet from sand/clay contact |
| 4 | 4 O.F. | 2 | D. | 282 | 10 | 7M | | S. | | S.C. | D. | Well is bottomed on clay |
| 5 | 4 O.F. | 2 | D. | 280 | 7 | 5M | | S.&C. | | | N. | |
| 5A | 4 O.F. | 2 | D. | 281 | 13 | 8M | | S.&C. | | H.C. | D.S. | Sufficient |
| 6 | 4 O.F. | 2 | D. | 279 | 8 | 5M | | S./C. | | H.C. | D. | Sufficient |
| 7 | 4 O.F. | 2 | D. | 281 | 10 | 4M | | S. | | H.C. | D. | Well is bottomed on clay |
| 8 | 4 O.F. | 2 | D. | 280 | 8 | 5M | | S./C. | | H.C. | D. | Never dry |
| 9 | 4 O.F. | 2 | D. | 280 | 8 | 5M | | S./C. | | H.C. | D. | Sufficient |
| 10 | 4 O.F. | 2 | D. | 279 | | | | S./C. | | H.C. | D. | Sufficient |
| 11 | 4 O.F. | 2 | D. | 281 | 9 | 5M | | S.&C. | | S.C. | D. | Low during late summer |
| 12 | 4 O.F. | 2 | D. | 282 | 8 | 5M | | S./C. | 7+ | S.C. | D.S. | Sufficient |
| 13 | 4 O.F. | 2 | D. | 281 | 10 | 6M | | S./C. | | S.C. | D.S. | Never dry |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 4 O.F. | 2 | D. | 283 | 12 | 7M | | S./C. | | S.C. | D. | Never dry |
| 15 | 4 O.F. | 2 | D. | 282 | 8 | 6M | | S./C. | | S.C. | D. | Sufficient |
| 16 | 4 O.F. | 2 | D. | 281 | 10 | 9M | | S./C. | | S.C. | D.S. | Dry during late summer |
| 1 | 4 O.F. | 3 | D. | 283 | 12 | 8M | | S./C. | | S.C. | D. | Sufficient |
| 2 | 4 O.F. | 3 | D. | 282 | 8 | 6M | | S./C. | | H.C. | D. | Well is bottomed on clay |
| 2A | 4 O.F. | 3 | D. | 281 | 11 | 5M | | S./C. | 20+ | H.C. | S. | Water at 8 feet from sand/clay contact |
| 3 | 4 O.F. | 3 | D. | 282 | 13 | 10M | | S./C. | 12+ | S.C. | D. | Well is bottomed on clay |
| 4 | 4 O.F. | 3 | D. | 283 | 12 | 7 | | S./C. | | S.C. | D. | Well is bottomed on clay |
| 5 | 4 O.F. | 3 | D. | 280 | 10 | 6M | | S./C. | | S.C. | D. | Well is bottomed on clay |
| 6 | 4 O.F. | 3 | D. | 283 | 9 | 6M | | S./C. | | S.C. | D. | Well is bottomed on clay |
| 7 | 4 O.F. | 3 | D. | 285 | 16 | 10 | | S./C. | | H.C. | D. | Never dry; at house |
| 7A | 4 O.F. | 3 | D. | 284 | 9 | 6M | | S./C. | | S.C. | S. | Never dry; at barn |
| 8 | 4 O.F. | 3 | D. | 283 | 9 | 7M | | S. | | H.C. | D. | Never dry |
| 8A | 4 O.F. | 3 | D. | 280 | 5 | 3M | | S. | 5+ | S.C. | S. | Goes dry |
| 1 | 4 O.F. | 4 | D. | 281 | | | | S. | | | D. | Information incomplete |
| 2 | 4 O.F. | 4 | D. | 281 | 8 | 5M | | S./C. | | H.C. | D. | Never dry |
| 3 | 4 O.F. | 4 | D. | 278 | 9 | 4M | | S./C. | | S.C. | D. | Sufficient |
| 4 | 4 O.F. | 4 | D. | 284 | 9 | 6 | | S./C. | | S.C. | D. | Goes dry |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 4 O.F. | 4 | D. | 283 | 11 | | | S./C. | | H.C. | D. | Goes dry |
| 5A | 4 O.F. | 4 | D. | 281 | 8 | 5M | | S. | | S.Cl. | D. | Sufficient |
| 6 | 4 O.F. | 4 | D. | 281 | 11 | 3 | | S./C. | | H.C. | D. | Water at 4 feet from sand/clay contact |
| 7 | 4 O.F. | 4 | D. | 283 | | | | | | | D. | Sufficient for school |
| 8 | 4 O.F. | 4 | D. | 279 | 9 | 6M | | S./C. | | H.C. | D. | Never dry |
| 9 | 4 O.F. | 4 | D. | 281 | 13 | 6M | | S./C. | | S.C. | D. | Water at 9 feet from sand/clay contact |
| 10 | 4 O.F. | 4 | D. | 271 | 8 | 3 | | C.(?) | | S.C. | D. | Never dry |
| 1 | 4 O.F. | 5 | D. | 270 | 9 | 6M | | S./C. | 30+ | H.C. | D.S. | Never dry |
| 1A | 4 O.F. | 5 | D. | 282 | 11 | 7M | | S. | | H.C. | N. | Never dry; at barn |
| 1 | 4 O.F. | 6 | D. | 260 | 7 | 4M | | S.(?) | | H.C. | N. | At house |
| 1A | 4 O.F. | 6 | Drl. | 258 | 150 | 0 | | Bi. | | S.C.Sul. | D. | Sufficient; at barn |
| 1 | 4 O.F. | 7 | D. | 258 | 16 | 10M | | S.(?) | | H.C. | D. | Never dry; at house |
| 1A | 4 O.F. | 7 | Drl. | 258 | 300 | | | Bi. | | S.C.Sul. | S. | Never dry; at barn |
| 1 | 4 O.F. | 8 | D. | 229 | 12 | 6M | | C. | | | N.(?) | |
| 1 | 4 O.F. | 10 | D. | 225 | 20 | 10 | | S.&C. | | H.Cl. | D. | Sufficient |
| 1A | 4 O.F. | 10 | D. | 225 | 24 | 9M | | S.&C. | | H.C. | S. | Never dry |
| 2 | 4 O.F. | 10 | Drl.(?) | 220 | 10 | | | S.&C. | | H.C. | N. | |
| 3 | 4 O.F. | 10 | D. | 240 | 13 | 9M | | S. | | S.C. | D. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3A | 4 O.F. | 10 | D. | 228 | 9 | 3M | | S./C. | | S.C. | N. | |
| 4 | 4 O.F. | 10 | D. | 244 | 15 | 10 | | S. | | S.C. | D. | Sufficient; at house |
| 4A | 4 O.F | 10 | D. | 243 | 8 | 8M | | S. | 6+ | S.C. | S. | Sufficient; at barn |
| 1 | 4 O.F. | 11 | D. | 249 | 15 | 9 | | S./C. | | S.C. | D. | Water at 6 feet from sand/clay contact |
| 1A | 4 O.F. | 11 | Drl. | 250 | 200 | 70 | 180 | Bi. | | C.Sal. | S. | Excellent supply; at barn |
| 2 | 4 O.F. | 11 | D. | 248 | 15 | 10 | | S. | | S.C. | D. | Sufficient |
| 2A | 4 O.F. | 11 | D. | 247 | 15 | 10 | | S./C. | | S.C. | D. | Water from sand/clay contact |
| 3 | 4 O.F. | 11 | D. | 255 | 8 | 4M | | S. | | S.C. | N. | Well bottomed on clay |
| 4 | 4 O.F. | 11 | D. | 261 | 11 | 4 | | S./C. | 15+ | S.C. | D.S. | Well bottomed on clay |
| 4A | 4 O.F. | 11 | D. | 261 | 7 | 4 | | S./C. | | S.C. | S. | Well bottomed on clay |
| 1 | 4 O.F. | 12 | D. | 259 | | | | S. | | | D.S. | Information incomplete |
| 2 | 4 O.F. | 12 | D. | 253 | 8 | 5M | | S./C. | | S.C. | D. | Well bottomed on clay |
| 2A | 4 O.F. | 12 | D. | 252 | 9 | 5M | | S. | | S.C. | S. | Sufficient; at barn |
| 3 | 4 O.F. | 12 | D. | 2 59 | 11 | 7M | | S. | 50+ | S.C. | D. | Sufficient; at house |
| 3A | 4 O.F. | 12 | D. | 255 | 8 | 4 | | S. | 7+ | S.C. | S. | Sufficient; at barn |
| 1 | 4 O.F. | 13 | D. | 257 | 9 | 8M | | S.&C. | 12+ | H.C. | D.S. | Sufficient |
| 2 | 4 O.F. | 13 | D. | 259 | 6 | 5M | | S.&C. | | H.C. | D. | Sufficient |
| 3 | 4 O.F. | 13 | D. | 257 | 8 | 6M | | S.&C. | | H.C. | D. | Low during late summer |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 O.F. | 14 | D. | 259 | 11 | 5M | | S.&C. | | H.C. | S. | Low during late summer |
| 2 | 4 O.F. | 14 | D. | 261 | 11 | 9M | | S./C. | | S.C. | D. | Water at 5 feet from sand/clay contact |
| 2A | 4 O.F. | 14 | D. | 261 | 11 | 10 | | S./C. | | H.C. | S. | Goes dry |
| 2B | 4 O.F. | 14 | Spr. | 223 | 0 | 0 | | S./C. | | H.C. | S. | Water from sand/clay contact |
| 1 | 4 O.F. | 15 | D. | 257 | 6 | 5M | | S. | | | N. | |
| 2 | 4 O.F. | 15 | D. | 258 | 7 | 6M | | S./C. | | S.C. | D. | Water from sand/clay contact |
| 3 | 4 O.F. | 15 | D. | 258 | 11 | 9M | | S./C. | | S.C. | D. | Water at 9 feet from sand/clay contact |
| 4 | 4 O.F. | 15 | D. | 254 | 12 | 5M | | S. | | H.C.* | D. | Sufficient for school; 55° F |
| 5 | 4 O.F. | 15 | D. | 254 | | | | S. | | H.C. | D.S. | Sufficient; at house |
| 6 | 4 O.F. | 15 | D. | 218 | 3 | | | S./C. | | H.C. | S. | Sufficient; in field |
| 1 | 4 O.F. | 16 | D. | 255 | 7 | 6 | | S. | | H.C. | D. | Goes dry during late summer |
| 2 | 4 O.F. | 16 | D. | 250 | 16 | | | S./C. | | H.C. | D. | Sand very thin; water from clay(?) |
| 3 | 4 O.F. | 16 | D. | 257 | 13 | 6 | | S./C. | | S.C. | D. | Water at 4 feet from sand/clay contact |
| 3A | 4 O.F. | 16 | D. | 252 | 10 | 6 | | S./C. | 62+ | H.C. | S. | Sufficient |
| 1 | 4 O.F. | 17 | D. | 252 | 23 | 9M | | S./C. | | S.C. | D.S. | Sufficient |
| 1A | 4 O.F. | 17 | Drl. | 253 | | | | | | C.Sal. | S. | Information incomplete |
| 1B | 4 O.F. | 17 | Spr. | 220(?) | | 0 | | S./C. | | S.C. | S. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 O.F. | 18 | D. | 251 | 19 | 10 | | S./C. | | H.C. | D. | Low during late summer; at house |
| 1A | 4 O.F. | 18 | D. | 257 | 14 | 9 | | S./C. | 25+ | H.C. | S. | Water at 6 feet from sand/clay contact |
| 1B | 4 O.F. | 18 | Spr. | 212 | 0 | 0 | | C.(?) | | S.C. | N. | |
| 2 | 4 O.F. | 18 | D. | 262 | 12 | 8 | | S./C. | 25+ | H.C. | D.S. | Low during late summer |
| 2A | 4 O.F. | 18 | Spr. | 215 | 0 | 0 | | S./C. | 25+ | H.C. | S. | Water from sand/clay contact |
| 1 | 4 O.F. | 19 | D. | 257 | 12 | 9M | | S./C. | | H.C. | D.S. | Sufficient; in house |
| 2 | 4 O.F. | 19 | D. | 254 | 14 | 6M | | S./C. | | S.C. | D. | Water at 4 feet from sand/clay contact |
| 2A | 4 O.F. | 19 | D. | 258 | 15 | 7M | | S./C. | | S.C. | D.S. | Sufficient; at barn |
| 3 | 4 O.F. | 19 | D. | 255 | 13 | 8M | | S./C. | | S.C. | D. | Sufficient; at house |
| 3A | 4 O.F. | 19 | D. | 258 | 11 | 7M | | S./C. | 18+ | H.C. | S. | Sufficient; at barn |
| 4 | 4 O.F. | 19 | Spr. | 209 | 0 | 0 | | C.(?) | | C.Sal. | N. | Previously used for medicinal purposes |
| 1 | 4 O.F. | 20 | D. | 255 | 19 | 15M | | S./C. | | H.C. | N. | Low during late summer |
| 1A | 4 O.F. | 20 | Drl. | 256 | 105 | 30 | 105 | G.(?) | | H.C. | D.S. | Excellent supply; water from gravel below clay; $43\frac{1}{2}^{\circ}$ F |
| 2 | 4 O.F. | 20 | D. | 256 | 15 | 10M | | S./C. | | H.C. | N. | At house |
| 2A | 4 O.F. | 20 | Drl. | 256 | 212 | 45 | 97 | Ca. | | H.C.Sal.* | D. | Excellent supply; $52^{\circ}$ F in house |
| 3 | 4 O.F. | 20 | Drl. | 253 | | 8M | 50 | S./C. | 12 | H.C. | D.S. | Previously dug 23 feet with limited supply |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3A | 4 O.F. | 20 | D. | 230 | 16 | 3M | | C. | | | N. | |
| 1 | 5 O.F. | 8 | D. | 249 | 15 | 13M | | S./C. | | H.C. | D.S. | Excellent supply |
| 2 | 5 O.F. | 8 | D. | 232 | 14 | 8M | | S.&C. | | S.C. | D. | Water from the clay (?) |
| 2A | 5 O.F. | 8 | D. | 233 | 8 | 6M | | S.&C. | | S.C. | S. | Sufficient |
| 3 | 5 O.F. | 8 | D. | 234 | 8 | 4 | | S.&C. | | S.C. | D.S. | Sufficient |
| 1 | 5 O.F. | 9 | D. | 236 | 12 | 11M | | S.&C. | | H.C. | D. | Low in late summer |
| 1A | 5 O.F. | 9 | D. | 234 | 9 | 5M | | C.(?) | 5+ | H.C. | S. | Sufficient |
| 1B | 5 O.F. | 9 | D. | 236 | 11 | 6M | | C.(?) | 5+ | H.C. | S. | Sufficient |
| 2 | 5 O.F. | 9 | D. | 231 | 12 | 3M | | S.(?) | | H.C. | D.S. | Sufficient |
| 3 | 5 O.F. | 9 | D. | 243 | 6 | 0 | | S. | | H.C. | D.S. | Sufficient |
| 1 | 5 O.F. | 10 | Spr. | 241 | 0 | 0 | | S. | | H.C. | N. | On north - facing bluff |
| 1 | 5 O.F. | 11 | D. | 252 | 12 | 8M | | S. | | | N. | |
| 1A | 5 O.F. | 11 | Spr. | 233 | 3 | 0 | | S. | | S.C. | N. | On north - facing bluff |
| 1 | 5 O.F. | 12 | D. | 248 | | | | S. | | H.C. | D.S. | Sufficient |
| 2 | 5 O.F. | 12 | D. | 246 | 19 | 5M | | S. | | H.C. | D. | Sufficient |
| 1 | 5 O.F. | 13 | D. | 249 | 17 | 7M | | S./C. | 7+ | H.C. | D.S. | Sufficient; in field |
| 1 | 5 O.F. | 14 | D. | 256 | 13 | 8M | | S./C. | | | N. | Vacant house |
| 1A | 5 O.F. | 14 | D. | 248 | 11 | 6M | | S./C. | | | N. | In field |
| 2 | 5 O.F. | 14 | D. | 255 | 15 | | | S./C. | | H.C. | D. | Low during late summer; thin sand layer |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2A | 5 0.F. | 14 | D. | 250 | 20 | | | S./C. | | H.C. | S. | Low during late summer; thin sand layer |
| 1 | 5 0.F. | 15 | D. | 256 | 17 | 10M | | S./C. | | S.C. | D. | Low during late summer |
| 1A | 5 0.F. | 15 | D. | 251 | 12 | 7M | | S./C. | | H.C. | S. | Sufficient; thin sand layer |
| 1B | 5 0.F. | 15 | D. | 251 | 6 | 3 | | S./C. | | H.C. | S. | Sufficient; in field |
| 2 | 5 0.F. | 15 | D. | 252 | 30 | 19M | | C. | | | D.S. | Deep dug well; thin sand layer |
| 3 | 5 0.F. | 15 | D. | 252 | | | | S./C. | | H.C. | D. | Sufficient for school |
| 1 | 5 0.F. | 16 | D. | 237 | 11 | 4M | | C. | | H.C. | S. | Sufficient; in field |
| 2 | 5 0.F. | 16 | D. | 251 | | | | C. | | H.C. | H.C. | Sufficient; at house |
| 2A | 5 0.F. | 16 | Drl. | 250 | 197 | | 197(?) | Ca(?) | | H.Sal. | S. | Too saline for domestic use |
| 2B | 5 0.F. | 16 | D. | 250 | | | | C. | | H.C. | D.S. | Never dry; at barn |
| 1 | 5 0.F. | 17 | D. | 232 | 19 | 10 | | C. | | H.C. | D. | Sufficient |
| 2 | 5 0.F. | 17 | D. | 245 | 18 | 9 | | C. | | H.C. | D. | Goes dry; at house |
| 2A | 5 0.F. | 17 | Drl. | 241 | 200 | | 180 | Ca. | | H.C,Sal. | S. | Too saline for domestic use; at barn |
| 2B | 5 0.F. | 17 | D. | 227 | 16 | 10M | | C. | | H.C. | S. | Sufficient |
| 3 | 5 0.F. | 17 | D. | 258 | 12 | 5 | | S./C. | | S.C. | D. | Never dry; at house |
| 3A | 5 0.F. | 17 | Drl. | 255 | 186 | | None | S. | | C.Sal. | S. | Water from sand under clay; at barn |
| 1 | 5 0.F. | 18 | D. | 244 | | | | C. | | H.C. | D. | Sufficient; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 5 O.F. | 18 | D. | 247 | | | | C. | | H.C. | S. | Sufficient; at barn |
| 2 | 5 O.F. | 18 | D. | 247 | 18 | 5 | | C. | | H.C. | D. | Sufficient; at house |
| 2A | 5 O.F. | 18 | Drl. | 247 | 200 | 5 | None | G.(?) | | H.C.Sal. | D.S. | Water from gravel (?) beneath clay |
| 2B | 5 O.F. | 18 | D. | 246 | 16 | 5 | | C. | | H.C. | S. | Sufficient |
| 1 | 5 O.F. | 19 | Drl. | 248 | 189 | 5M | 189 | C.(?) | | H.C.Sal. | S. | Water at 189 feet from clay/ Carlsbad contact |
| 2 | 5 O.F. | 19 | D. | 250 | 10 | 6M | | | | | N. | Information incomplete |
| 3 | 5 O.F. | 19 | D. | 230 | | | | C.(?) | | H.C. | D.S. | Information incomplete; at barn |
| 4 | 5 O.F. | 19 | D. | 268 | 8 | 5M | | | | | N. | |
| 1 | 5 O.F. | 20 | Drl. | 247 | 169 | | | Ca. | 12+ | S.C. | D.S. | Sufficient |
| 2 | 5 O.F. | 20 | D. | 255 | 25 | 12M | | C. | | H.C. | D. | Sufficient for house & garage |
| 3 | 5 O.F. | 20 | D. | 253 | 25 | 13 | | C. | | S.C. | D. | Sufficient |
| 4 | 5 O.F. | 20 | D. | 261 | 23 | 16M | | C. | | H.C. | D.S. | Sufficient; at house |
| 4A | 5 O.F. | 20 | D. | 262 | 15 | 6M | | C. | | | G. | Sufficient |
| 5 | 5 O.F. | 20 | D. | 261 | 12 | 8 | | C. | | H.C. | D. | Sufficient |
| 5A | 5 O.F. | 20 | Drl. | 263 | 149 | | | G. | | C.Sal. | D. | Water from gravel beneath clay |
| 1 | 6 O.F. | 4 | D. | 249 | 15 | 10 | | S. | | H.C. | D.S. | Well is bottomed in clay |
| 1 | 6 O.F. | 6 | D. | 233 | 7 | 5M | | S./C. | | S.C. | D. | Water at 5 feet from sand/clay contact |
| 2 | 6 O.F. | 6 | D. | 226 | 15 | 12M | | S. | | H.C. | N. | Goes dry |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2A | 6 O.F. | 6 | D. | 237 | 24 | 2M | | S./C. | | H.C. | D. | Never dry |
| 2B | 6 O.F. | 6 | D. | 235 | 3 | 2M | | S./C. | | H.C. | N. | Never dry |
| 1 | 6 O.F. | 7 | Drl. | 229 | 133 | 6M | 126 | Ca. | | H.C.Sal. | S. | Sufficient; at barn |
| 1A | 6 O.F. | 7 | D. | 228 | 16 | 2M | | C. | | | N. | At barn |
| 1B | 6 O.F. | 7 | D. | 229 | 11 | 6M | | C. | | | N. | At barn |
| 1C | 6 O.F. | 7 | D. | 229 | 13 | 8M | | C. | | H.C. | D.S. | Sufficient; at house |
| 2 | 6 O.F. | 7 | D. | 236 | 14 | 8M | | S./C. | | H.C. | D.S. | Sufficient |
| 1 | 6 O.F. | 8 | D. | 228 | 20 | | | C. | | C.Sul. | S. | Goes dry; at house |
| 1A | 6 O.F. | 8 | Drl. | 227 | 95 | +2 | | Ca(?) | 20 | H.C.Sal. | D.S. | Flowing well; water contains considerable gas |
| 1 | 6 O.F. | 9 | D. | 234 | 20 | | | C. | | H.C.Sal. | D.S. | Sufficient |
| 2 | 6 O.F. | 9 | D. | 248 | 20 | | | C.(?) | | H.C.Sal. | D. | Sufficient; at house |
| 2A | 6 O.F. | 9 | Drl. | 233 | 110 | 0 | 110 | G. | | H.C.Sal. | S. | Water in gravel beneath clay and directly above Carlsbad |
| 1 | 6 O.F. | 10 | D. | 250 | 20 | | | C. | | H.C. | D. | Low during late summer |
| 1A | 6 O.F. | 10 | D. | 251 | 8 | 7M | | C. | | H.C. | S. | Low during late summer; at barn |
| 1B | 6 O.F. | 10 | D. | 251 | 18 | 11M | | C. | | H.C. | S. | Low during late summer; at barn |
| 1C | 6 O.F. | 10 | D. | 240 | 14 | 10M | | C. | | H.C. | S. | Low during late summer; in field |
| 2 | 6 O.F. | 10 | D. | 260 | 10 | 7 | | S./C. | 8+ | H.C. | D.S. | Water at 9 feet from sand/clay contact |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 O.F. | 11 | D. | 251 | 12 | 8 | | C. | | H.C. | D.S. | Sufficient; at barn |
| 1A | 6 O.F. | 11 | Drl. | 249 | 150 | | None | G.(?) | | H.C.Sal. | N. | Water too saline to be used |
| 1B | 6 O.F. | 11 | D. | 264 | 8 | 6M | | S. | | H.C. | S. | Sufficient; in field |
| 2 | 6 O.F. | 11 | D. | 256 | 11 | 7M | | S. | | H.C. | N. | Never dry |
| 1 | 6 O.F. | 12 | D. | 256 | 11 | 3 | 135 | S. | | H.C. | D. | Water at 11 feet from sand/clay contact |
| 1A | 6 O.F. | 12 | D. | 253 | 6 | 3 | | S. | | H.C. | S. | Never dry; in field |
| 2 | 6 O.F. | 12 | D. | 244 | 20 | | | C. | | H.C. | D. | Sufficient; at house |
| 2A | 6 O.F. | 12 | D. | 234 | 16 | 5M | | C. | | H.C. | N. | |
| 2B | 6 O.F. | 12 | D. | 244 | 12 | 7M | | C. | | H.C. | N. | In field |
| 2C | 6 O.F. | 12 | D. | 246 | 11 | 7M | | C. | | H.C. | S. | Sufficient |
| 1 | 6 O.F. | 13 | D. | 234 | 24 | 7M | | C. | | | N. | At barn |
| 2 | 6 O.F. | 13 | D. | 244 | 11 | 7M | | C. | | H.C. | D. | Low during late summer; at house |
| 2A | 6 O.F. | 13 | D. | 232 | 9 | 6 | | C. | | H.C.Sal. | S. | Low during late summer |
| 3 | 6 O.F. | 13 | D. | 264 | 10 | 5M | | S. | | H.C. | D.S. | Sufficient |
| 1 | 6 O.F. | 14 | D. | 245 | 21 | 8M | | C. | | H.C. | N. | Low during late summer; at house |
| 1A | 6 O.F. | 14 | Drl. | 245 | 17+ | | None(?) | G.(?) | | H.C.Sal. | N. | Water too saline to be used |
| 2 | 6 O.F. | 14 | D. | 254 | 10 | | | S./C. | | H.C. | D.S. | Never dry; (in field) |
| 1 | 6 O.F. | 15 | D. | 245 | | | | C. | | | S. | Information incomplete; at barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 O.F. | 16 | D. | 252 | 20 | 9 | | S./C. | 18+ | H.C. | D.S. | Sufficient; at house |
| 1A | 6 O.F. | 16 | Drl. | 253 | 196 | | None | G.(?) | | H.C.Sal. | S. | Water too saline for domestic use |
| 1B | 6 O.F. | 16 | D. | 255 | 16 | 7 | | C. | | H.C. | S. | Sufficient; in field |
| 2 | 6 O.F. | 16 | D. | 259 | 28 | 14 | | S./C. | 5+ | H.C.Sal. | D.S. | Water at 25 feet from sand/ clay contact |
| 1 | 6 O.F. | 17 | D. | 254 | 12 | 6 | | C. | | H.C. | D. | Low during late summer |
| 1 | 6 O.F. | 18 | D. | 262 | 14 | 9M | | S. | | H.C. | D. | Sufficient |
| 1A | 6 O.F. | 18 | D. | 260 | 9 | 6M | | S. | | H.C. | N. | |
| 2 | 6 O.F. | 18 | D. | 261 | 8 | 5M | | S. | | H.C. | S. | Sufficient; in field |
| 3 | 6 O.F. | 18 | Drl. | 242 | 208 | | 195 | Ca. | | H.C.Sal. | N. | Water too saline for use. |
| 1 | 6 O.F. | 19 | D. | 256 | 20(?) | | | C. | | H.C. | D. | Low during late summer |
| 1A | 6 O.F. | 19 | Spr. | | 0 | 0 | | S. | | H.C. | S. | Never dry; in field |
| 2 | 6 O.F. | 19 | D. | 267 | 16 | 10 | | S./C. | | H.C. | D. | Never dry; at house |
| 2A | 6 O.F. | 19 | D. | 269 | 8 | 5 | | S. | | H.C. | S. | Never dry; at barn |
| 1 | 6 O.F. | 20 | D. | 253 | 11 | 6M | | C. | | H.C. | D.S. | Goes dry during late summer |
| 2 | 6 O.F. | 20 | D. | 259 | 12 | 9 | | S. | | H.C. | D. | Sufficient; at house |
| 3 | 6 O.F. | 20 | Drl. | 261 | 169 | 6M | None(?) | G.(?) | 7+ | | S. | Sufficient; at barn |
| 1 | 7 O.F. | 1 | D. | 233 | 13 | 11M | | C. | | | | Well under construction |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 7 O.F. | 1 | D. | 237 | 13 | 10M | | C. | | | D. | Information incomplete |
| 3 | 7 O.F. | 1 | D. | 235 | 17 | 11 | | C. | | H.C. | D. | Never dry |
| 4 | 7 O.F. | 1 | D. | 230 | 16 | 11 | | C. | | H.C. | D. | Sufficient; at house |
| 4A | 7 O.F. | 1 | Drl. | 232 | 100 | 11 | 90 | G. | | H.C.Sal. | S. | Water at 85 feet in sandy gravel beneath clay; at barn |
| 1 | 7 O.F. | 2 | D. | 247 | 9 | 8M | | S. | | | | Incomplete information |
| 2 | 7 O.F. | 2 | D. | 246 | 8 | 5M | | S.&C. | | | S. | In field |
| 1 | 7 O.F. | 3 | D. | 223 | 12 | 8 | | C. | | H.C. | D. | Goes dry |
| 2 | 7 O.F. | 3 | D. | 225 | 11 | 5M | | C. | | S.C. | D. | Two feet of sand overlying clay |
| 3 | 7 O.F. | 3 | D. | | | | | | | S.C. | D. | Incomplete information |
| 4 | 7 O.F. | 3 | D. | 224 | 12 | 10M | | C. | | S.C. | D. | Sufficient |
| 5 | 7 O.F. | 3 | D. | 226 | 13 | 8 | | C. | | H.C. | D. | Goes dry |
| 6 | 7 O.F. | 3 | Drl. | 220 | 150 | 3 | 48 | Ca. | | H.C. | D.B. | Sufficient; at Johnstons Hotel |
| 6A | 7 O.F. | 3 | D. | 220 | 15 | 10 | | C. | | H.C. | D. | Sufficient; at Johnstons Hotel |
| 6B | 7 O.F. | 3 | Drl. | 220 | 115 | +3 | 50 | Ca. | | S.C. | B. | Sufficient |
| 7 | 7 O.F. | 3 | Drl. | 220 | | | 55 | | | | N. | At Carlsbad Springs Hotel |
| 8 | 7 O.F. | 3 | D. | 246 | 13 | 10M | | S. | | H.C. | N. | At barn |
| 9 | 7 O.F. | 3 | D. | 237 | 11 | 6M | | S. | | | D. | Sufficient; at house |
| 9A | 7 O.F. | 3 | D. | 236 | 9 | 6M | | S./C. | | | S. | Sufficient; at barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 O.F | 4 | | | | | | | | | | |
| 1A | 7 O.F. | 4 | | | | | | | | | | |
| 1B | 7 O.F. | 4 | | | | | | | | | | |
| 2 | 7 O.F. | 4 | D. | 242 | 14 | 10M | | C. | | H.C. | D | Sufficient; at house |
| 2A | 7 O.F. | 4 | D. | 232 | 23+ | 9M | | C. | | S.Cl. | N. | |
| 2B | 7 O.F. | 4 | D. | 238 | 7 | 4M | | C. | | H.C. | S. | Sufficient; at barn |
| 2C | 7 O.F. | 4 | D. | 225 | 7 | 4M | | C. | | H.C. | S. | Sufficient; in field |
| 3 | 7 O.F. | 4 | D. | 227 | 12 | 9M | | C. | | H.C. | D. | Sufficient |
| 4 | 7 O.F. | 4 | D. | 232 | 18 | 15M | | C. | | H.C. | D. | Low during late summer |
| 5 | 7 O.F. | 4 | D. | 232 | 13 | 8M | | S. | | H.C. | D. | Never dry; at Carlsbad Springs Lodge |
| 5A | 7 O.F. | 4 | Drl. | 232 | 80+ | 10M | | Ct.(?) | | H.C.Cl. | D.B. | " " " " " " |
| 6 | 7 O.F. | 4 | D. | 232 | 15 | 8M | | C. | | H.C. | D. | Sufficient |
| 1 | 7 O.F. | 5 | D. | 227 | 3 | 2M | | S./C. | | H.C. | D.S. | Sufficient |
| 1A | 7 O.F. | 5 | D. | 233 | 9 | 7M | | S./C. | | | N. | At house |
| 2 | 7 O.F. | 6 | D. | 230 | 16 | | | S./C. | | H.C. | D. | Sufficient; at house |
| 2A | 7 O.F. | 6 | D. | 230 | 16 | 8M | | S./C. | | H.C. | S. | " ; at barn |
| 1 | 7 O.F. | 6 | D. | 228 | 12 | 11 | | S./C. | | S.C. | D. | " ; at house |
| 1A | 7 O.F. | 6 | D. | 228 | 12 | 6 | 100+ | S./C. | | S.C. | D. | " ; at barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1B | 7 O.F. | 6 | D. | 223 | 12 | 10 | | S./C. | | S.C. | S. | Sufficient |
| 2 | 7 O.F. | 6 | D. | 256 | 14 | 6 | | S./C. | | H.C. | D. | Water at 8 feet from sand/clay contact |
| 2A | 7 O.F. | 6 | Spr. | | 0 | 0 | | S./C. | | H.C. | N. | In field |
| 2B | 7 O.F. | 6 | Spr. | | 0 | 0 | | S./C. | | H.C. | N. | " " |
| 1 | 7 O.F. | 7 | D. | 223 | 17 | 14M | | S./C. | | H.C.Sal. | S. | Sufficient |
| 2 | 7 O.F. | 7 | D. | 234 | 20 | 12 | | C. | | H.C. | D. | " |
| 2A | 7 O.F. | 7 | D. | 222 | 22 | 5 | | C. | | H.C. | S. | " |
| 1 | 7 O.F. | 8 | Drl. | 244 | 24 | 7 | None | S./C. | | C.Min. | D.S. | " |
| | 7 O.F. | 9 | D. | 256 | 10 | 6M | | C. | | H.C. | D.S. | " |
| 1 | 7 O.F. | 10 | D. | 248 | 12 | | 110(?) | C. | | H.C. | D. | " ; at barn |
| 1A | 7 O.F. | 10 | D. | 248 | 16 | | | S. | | H.C. | D.S. | Never dry; in field south of barn |
| 1 | 7 O.F. | 11 | D. | 253 | 16 | 7M | | S./C. | | | | Sufficient |
| 1 | 7 O.F. | 12 | D. | 262 | 12 | 6 | | S. | | H.C.Sul. | D. | " |
| 2 | 7 O.F. | 12 | D. | 255 | 10 | 9M | | S. | | S.Cl. | D.S. | Never dry |
| 1 | 7 O.F. | 13 | D. | 260 | 13 | 9 | 110(?) | C. | | H.C. | D. | Also a 110-foot,dry hole through clay to bedrock |
| 1A | 7 O.F. | 13 | D. | 258 | 15 | | | C. | | H.Cl. | S. | Large diameter well; connected to field drainage ditch |
| 1B | 7 O.F. | 13 | D. | 259 | 13 | | | C. | | H.C. | S. | Sufficient; at barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 7 O.F. | 14 | D. | 252 | 13 | 7M | | C.(?) | | H.Cl. | G. | Sufficient |
| 1A | 7 O.F. | 14 | Drl. | 251 | 120 | | 120 | G./Ca | | H.C.Sal.☆ | D.S. | Water probably from gravel over bedrock: very saline: 56°F.; at barn |
| 2 | 7 O.F. | 14 | D. | 257 | | | | S. | | H.C. | G. | Sufficient; at barn |
| 2A | 7 O.F. | 14 | D. | 261 | 15 | 8M | | S. | 15+ | S.C. | D.S. | Excellent supply; in field |
| 1 | 7 O.F. | 15 | D. | 264 | | | | S. | | H.C. | D. | Sufficient; in house |
| 1A | 7 O.F. | 15 | D. | 263 | 16 | | | S. | | H.C. | S. | " ; at barn |
| 1 | 7 O.F. | 16 | Drl. | 261 | 206 | 9 | None | G. | | H.C.Sal. | D.S. | " ; at barn |
| 1 | 7 O.F. | 17 | D. | 274 | 12 | 6 | | S. | | H.C.☆ | D. | " ; 53°F: at house |
| 1A | 7 O.F. | 17 | D. | 270 | 15 | 9 | | S./C. | | H.C. | S. | Low during late summer; at barn |
| 1 | 7 O.F. | 18 | Drl. | 277 | 1744 | 6M | 204 | G.&.B.R. | | H.C.Sal. | S. | Unlimited supply; in field |
| 2 | 7 O.F. | 18 | D. | 273 | 9 | 8M | | S. | | H.C. | D. | Sufficient; at house |
| 2A | 7 O.F. | 18 | D. | 270 | 7 | 6M | | S. | | H.C. | S. | " ; at barn |
| 1 | 7 O.F. | 20 | D. | 272 | 11 | 5M | | G.& C. | | H.C. | D. | " |
| 1A | 7 O.F. | 20 | Drl. | 272 | 165 | | None(?) | G.(?) | 26+ | C.Sal. | S. | Water probably from gravel beneath clay |
| 2 | 7 O.F. | 20 | D. | 275 | 9 | 6M | | S./C. | | H.C. | D. | Well is bottomed in clay |
| 2A | 7 O.F. | 20 | D. | 273 | 7 | 3M | | S./C. | | H.C. | D.S. | Excellent supply |
| 3 | 7 O.F. | 20 | D. | 277 | 6 | 5M | | S. | | | N. | Well under construction |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 7 O.F. | 20 | D. | 275 | 10 | 7M | | S. | | H.C. | H.C. | Sufficient |
| 5 | 7 O.F. | 20 | D. | 283 | 9 | 6M | | S. | | H.C. | D. | " |
| 5A | 7 O.F. | 20 | D. | 282 | 9 | 6 | | S. | | S.C. | S. | " |
| 1 | 8 O.F. | 1 | D. | 241 | 16 | 12M | | C. | | H.C. | D. | " |
| 1A | 8 O.F. | 1 | Drl. | 241 | | | | C. | 5+ | S.C.Sal. | S. | Never dry |
| 2 | 8 O.F. | 1 | D. | 264 | 9 | 6M | | S. | | | N. | Vacant house |
| 1 | 8 O.F. | 2 | D. | 248 | 14 | 6M | | S.& C. | | H.C. | D. | Two feet of sand overlying clay |
| 1A | 8 O.F. | 2 | D. | 247 | 13 | 6 | | S.& C. | | S.C. | S. | Sufficient; at barn |
| 1B | 8 O.F. | 2 | Spr. | 248 | 4 | 0 | | S./C. | | H.C. | S. | " |
| 1 | 8 O.F. | 3 | D. | 255 | 12 | 9M | | S. | | H.C. | S. | " ; at house |
| 1A | 8 O.F. | 3 | D. | 256 | 12 | 8M | | S. | | H.C. | S. | " ; at barn |
| 2 | 8 O.F. | 3 | D. | 255 | 10 | 7M | | S. | | S.C. | D. | " |
| 3 | 8 O.F. | 3 | D. | 252 | 10 | 8M | | S. | | H.C. | D. | " ; at house |
| 3A | 8 O.F. | 3 | D. | 252 | 10 | 9M | | S. | | H.C. | S. | Never dry; at barn |
| 1 | 8 O.F. | 4 | D. | 260 | 9 | 7M | | S. | | S.C. | D. | " " |
| 1 | 8 O.F. | 5 | D. | 247 | 20 | 10M | | S. | | H.C.Sul. | D. | Sufficient |
| 2 | 8 O.F. | 5 | D. | 252 | 14 | 7M | | S. | | | N. | Vacant house |
| 2A | 8 O.F. | 5 | D. | 250 | 16 | 7M | | S. | | | N. | " barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 O.F. | 6 | D. | 245 | 6 | 1M | | S./C. | | H.C. | S. | Sufficient |
| 2 | 8 O.F. | 6 | D. | 255 | 14 | | | S./C. | | S.C. | D.S. | Never dry |
| 1 | 8 O.F. | 7 | D. | 254 | 11 | 8M | | S./C. | | S.C. | D. | Water at 5 feet from sand/clay contact |
| 1A | 8 O.F. | 7 | D. | 254 | 18 | 8M | | S./C. | 15+ | S.C. | S. | Not a sufficient supply |
| 1B | 8 O.F. | 7 | Drl. | 252 | | | | G.(?) | | Cl.Sal. | N. | Water probably from gravel under clay |
| 1 | 8 O.F. | 8 | D. | 257 | 13 | 9M | | S./C. | | S.C. | D. | Water at 10 feet from sand/clay contact |
| 2 | 8 O.F. | 8 | D. | 257 | 10 | 8M | | C. | | H.C. | D. | Sufficient; at house |
| 2A | 8 O.F. | 8 | D. | 254 | 13 | 6M | | C. | 12+ | H.C. | S. | " ; in barn |
| 3 | 8 O.F. | 8 | D. | 257 | 24 | 8M | | C. | | H.C. | D.(?) | " |
| 1 | 8 O.F. | 10 | D. | | | | | C. | 15+ | S.C. | D.S. | Never dry |
| 2 | 8 O.F. | 10 | D. | 255 | 12 | 9M | | C. | | H.C. | D. | Low during late summer |
| 2A | 8 O.F. | 10 | D. | 255 | 14 | 9 | | C. | | H.C. | D. | Sufficient |
| 3 | 8 O.F. | 10 | D. | 260 | 10 | 5M | | S. | | H.Cl. | D. | " ; for school |
| 1 | 8 O.F. | 11 | D. | 261 | 12 | 8M | | S.&C. | | H.C. | D.(?) | " |
| 1 | 8 O.F. | 12 | D. | 259 | 12 | 4M | | S./C. | | H.C. | D. | " ; at house |
| 1A | 8 O.F. | 12 | D. | 260 | 13 | 4 | | S./C. | 12+ | H.C. | S. | " ; at barn |
| 2 | 8 O.F. | 12 | D. | 265 | 19 | 8M | | C.(?) | | H.C. | D.(?) | " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 8 O.F. | 13 | D. | 256 | 16 | | | C. | | H.C.Sul. | S. | Goes dry during winter; at barn |
| 1B | 8.O.F. | 13 | Drl. | 256 | 100 | | 100 | | | C.Sal. | S. | Water at clay/Carlsbad contact; large quantities of gas under great pressure |
| 2 | 8 O.F. | 13 | D. | 257 | 13 | 9M | | C. | | H.Cl:Sul. | D. | Goes dry; well not sufficiently deep |
| 2A | 8 O.F. | 13 | D. | 259 | 12 | 8M | | C. | | | N. | |
| 2B | 8 O.F. | 13 | D. | 259 | 13 | | | C. | | H.C. | S. | " " " " " " |
| 3 | 8 O.F. | 13 | D. | 264 | 11 | 4M | | S. | 5+ | H.C. | D.S. | Water at 11 feet in sand beneath clay |
| 1 | 8 O,F. | 14 | D. | 260 | 28 | | | S.& C. | | H.C. | D. | Never dry; at house |
| 1A | 8 O.F. | 14 | D. | 259 | 14 | | | S. | | H.C. | S. | " " ; at barn |
| 1 | 8 O.F. | 15 | D. | 262 | 7 | 5M | | S. | | H.C. | D. | Sufficient; at house |
| 1A | 8 O.F. | 15 | D. | 263 | 13 | 12M | | S. | | H.C. | S. | " ; at barn |
| 2 | 8 O.F. | 15 | D. | 264 | 15 | | | S. | | S.C. | D.S. | " ; in field |
| 3 | 8 O.F. | 15 | D. | 262 | 15 | 6M | | C.(?) | | H.C. | D.S. | " |
| 1 | 8 O.F. | 16 | D. | 265 | 7 | | | S. | | H.C. | D. | " ; in house |
| 1A | 8 O.F. | 16 | D. | 263 | 6 | | | S. | | H.C. | S. | Goes dry during late summer |
| 1B | 8 O.F. | 16 | D. | 262 | 7 | | | S. | | H.C. | S. | Never dry; at barn |
| 1 | 8 O.F. | 17 | D. | 268 | 9 | 8M | | S. | | H.C. | D. | Sufficient |
| 1 | 8 O.F. | 18 | D. | 271 | 9 | 7M | | S. | | S.C. | D.S. | Never dry |
| 2 | 8 O.F. | 18 | D. | 268 | 12 | 7 | | S. | | S.C. | D.S. | Sand extremely fluid; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2A | 8 O.F. | 18 | D. | 268 | 16 | 8 | | S. | | S.C. | S. | Sufficient |
| 1 | 8 O.F. | 19 | Drl. | 272 | 186 | | | Ca.(?) | | H.C. | D.S. | Never dry |
| 1 | 8 O.F. | 20 | D. | 274 | 10 | 7M | | S. | | H.C. | D. | |
| 1A | 8 O.F. | 20 | D. | 272 | 16 | 12M | | S. | | S.C. | S. | Sufficient |
| 2 | 8.O.F. | 20 | D. | 276 | 8 | 6M | | S.& C. | | | N. | At barn |
| 1 | 9 O.F. | 1 | D. | 254 | 14 | 7M | | C.(?) | | H.C.Sul. | D.S. | Sufficient |
| 2 | 9 O.F. | 1 | D. | 253 | 16 | | | C. | | H.C. | D. | Never dry; at house |
| 2A | 9 O.F. | 1 | D. | 253 | 18 | | | C. | | H.C. | S. | " " ; at barn |
| 1 | 9 O.F. | 4 | D. | 249 | 12 | 9M | | S./C. | | H.C. | D. | Well is bottomed on clay |
| 1 | 9 O.F. | 5 | D. | 254 | 10 | 8 | | S./C. | | H.Cl. | S. | Sufficient; at house |
| 1A | 9 O.F. | 5 | D. | 251 | 16 | | | S. | | H.C. | S. | Low during late summer; at barn |
| 2 | 9 O.F. | 5 | D. | 249 | 18 | 13M | | S.& G. | | H.C. | D.S. | Sufficient |
| 3 | 9 O.F. | 5 | D. | 255 | 14 | 12M | | S. | 18+ | H.C. | D.S. | Never dry |
| 3A | 9 O.F. | 5 | D. | 254 | 15 | 8 | | S. | | H.C. | N.(?) | " " |
| 1 | 9 O.F. | 6 | D. | 256 | 10 | 6M | | S. | | H.C. | D. | Sufficient; at house |
| 1A | 9 O.F. | 6 | D. | 256 | 10 | 6 | | S.& C. | | H.C. | D.S. | " ; at barn |
| 2 | 9 O.F. | 6 | D. | 255 | 15 | 10M | | S.& C. | | H.C. | S. | " ; at barn |
| 3 | 9 O.F. | 6 | D. | 254 | 18 | 12M | | S.& G. | 12+ | H.C. | D.S. | Well is bottomed on clay |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9 O.F. | 7 | D. | 257 | 18 | 9 | | S. | | H.C. | S. | Never dry |
| 1A | 9 O.F. | 7 | D. | 254 | 20 | 6 | | C.(?) | 13+ | Cl.Sul. | S. | " " |
| 2 | 9 O.F. | 7 | D. | 256 | 9 | 7M | | S.(?) | | | | Information incomplete |
| 3 | 9 O.F. | 7 | D. | 257 | 18 | 11 | | C. | | H.C. | D. | Sufficient |
| 3A | 9 O.F. | 7 | D. | 259 | 19 | 16 | | C. | 6+ | H.C. | S. | Goes dry; at barn |
| 1 | 9 O.F. | 8 | D. | 256 | 20 | 10 | | C. | 37+ | H.C. | D.S. | Goes dry during late summer |
| 1 | 9 O.F. | 9 | Drl. | 260 | 90 | | None | G.(?) | | S.C. | D. | Water from gravel (?) beneath clay |
| 1A | 9 O.F. | 9 | D. | 262 | 16 | 10 | | C. | 5+ | H.Cl. | S. | Sufficient; at barn |
| 1B | 9 O.F. | 9 | D. | 259 | 14 | 13 | | C.(?) | | S.C. | N.(?) | |
| 1 | 9 O.F. | 10 | D. | 255 | 19 | 9 | | C. | | H.C.Sul. | D. | Clay beneath 3 feet of sand |
| 1 | 9 O.F. | 11 | D. | 264 | 17 | 14 | | C. | 14+ | H.C. | S. | Clay beneath 2 feet of sand |
| 1A | 9 O.F. | 11 | D. | 265 | 17 | 12 | | C. | | H.C. | S. | " " 2 " " " never dry |
| 1B | 9 O.F. | 11 | Drl. | 263 | 135 | | | Ca(?) | | H.Sal | N. | Water may be from gravel above Carlsbad |
| 2 | 9 O.F. | 11 | D. | 264 | 13 | 8 | | S.& C. | | H.C. | D. | Goes dry; at house |
| 2A | 9 O.F. | 11 | D. | 265 | 12 | 9 | | S.& C. | 27+ | H.C. | S. | " " ; at barn |
| 1 | 9 O.F. | 12 | D. | 264 | 13 | 9M | | C.(?) | | | N.(?) | |
| 2 | 9 O.F. | 12 | D. | 267 | 18 | | | S.& C. | | H.C. | D.S. | " " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 9 O.F. | 13 | D. | 264 | 13 | 7 | | S.& C. | | H.C. | D. | Never dry |
| 1A | 9 O.F. | 13 | D. | 266 | 12 | 6 | | S.& C. | 6+ | H.C. | S. | Sufficient |
| 2 | 9 O.F. | 13 | D. | 263 | 18 | 13 | | S.& C. | | H.C. | N. | |
| 2A | 9 O.F. | 13 | Drl. | 264 | 70 | | | G.(?) | 9+ | H.C.Sal. | S. | Water probably from gravel beneath clay |
| 1 | 9 O.F. | 16 | Drl. | 265 | 97 | 40 | None(?) | G.(?) | | H.Sal. | S. | Water very saline; probably from gravel beneath clay |
| 1 | 9 O.F. | 17 | D. | 268 | 11 | 6M | | S.(?) | | H.C. | D. | Never dry |
| 1A | 9 O.F. | 17 | Drl. | | | | None(?) | G.(?) | | C.Sal. | S. | " " ; water probably from gravel beneath clay |
| 1 | 9 O.F. | 18 | Drl. | 268 | | | None(?) | G.(?) | | C.Sal.(?) | N. | Water probably from gravel beneath clay |
| 1 | 9 O.F. | 19 | Drl. | 270 | 90 | 8 | None(?) | G.(?) | 18+ | S.C. | D.S. | Never dry |
| 1 | 9 O.F. | 20 | Drl. | 269 | 30+ | 6M | | | 12+ | H.C. | S. | Sufficient; at vacant house |
| 1 | 10 O.F. | 3 | Drl. | 257 | 43 | | 43 | G. | 31+ | H.C. | D.S. | Water at 41 feet from gravel beneath clay and above Carlsbad |
| 1A | 10 O.F. | 3 | Drl. | 258 | 43 | | 43 | G. | | H.C. | S. | Well similar to No. 1; in field |
| 2 | 10 O.F. | 3 | Drl. | 264 | 68 | 9M | 60 | G.(?) | | H.C.Min. | S. | Never dries; water from gravel beneath clay and above Carlsbad |
| 1 | 10 O.F. | 6 | D. | 248 | 12 | 7M | | S.&G. | | H.Cl. | D. | Sufficient |
| 1 | 10 O.F. | 7 | D. | 253 | 15 | 7M | | S.& C. | | H.C. | D.G. | " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 10 O.F. | 7 | D. | 258 | 15 | 7M | | S.& C. | | H.C. | D. | Sufficient |
| 3 | 10 O.F. | 7 | D. | 259 | 22 | 10M | | S.& C. | | S.C. | D. | " |
| 1 | 10 O.F. | 8 | D. | 258 | 16 | 7M | | S.& C. | | H.C. | D. | " ; for cheese factory |
| 1 | 10 O.F. | 9 | D. | 256 | 10 | 8M | | S.& C. | | H.Cl.Sul. | D. | " ; at house |
| 1A | 10 O.F. | 9 | D. | 256 | 24 | 7 | | S.& C. | | H.C. | S. | " ; in field |
| 2 | 10 O.F. | 9 | D. | 253 | 15 | 12M | | S.& C. | | H.C. | D.S. | " |
| 3 | 10 O.F. | 9 | D. | 258 | 13 | 12M | | S.& C. | | H.C. | D. | " |
| 1 | 10 O.F. | 10 | D. | 256 | | | | S.& C. | | S.C. | D. | " ; in house |
| 1A | 10 O.F. | 10 | D. | 262 | 17 | 11M | | S.& C. | | S.C. | S. | " ; at barn |
| 1 | 10 O.F. | 11 | D. | 261 | 11 | 7M | | S.& C. | | H.C. | D. | " ; at house |
| 1A | 10 O.F. | 11 | D. | 260 | 15 | 7M | | S.& C. | | H.C. | S. | " ; at barn |
| 1 | 10 O.F. | 12 | D. | 260 | 16 | 8 | | S.& C. | | H.C.Sal. | D. | " ; at house |
| 1A | 10 O.F. | 12 | Drl. | 260 | 110 | 4 | 80 | Ca. | | C.Sul.Sal. | S. | Excellent supply; at barn |
| 1 | 10 O.F. | 13 | D. | 261 | 20 | 10M | | S.& C. | | H.C.Sal. | D. | Low during late summer |
| 1A | 10 O.F. | 13 | Drl. | 261 | 110 | | 90 | Ca. | | C.Sul.Sal. | D.S. | Sufficient; at barn |
| 1 | 10 O.F. | 14 | D. | 261 | 14 | 8M | 90 | S.& C. | | H.C. | D. | " ; at house |
| 1A | 10 O.F. | 14 | Drl. | 261 | 100+ | 5M | 90 | Ca. | 60+ | C.Sal. | S. | " ; at barn |
| 2 | 10 O.F. | 14 | D. | 260 | 17 | 8 | | S.& C. | | H.C. | D. | " ; at house |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2A | 10 O.F. | 14 | Drl. | 261 | 127 | 4 | 100 | Ca. | | H.C.Sal. | S. | Sufficient; at barn |
| 1 | 10 O.F. | 15 | D. | 259 | 24 | 5 | | C. | | H.C. | D. | " ; at house |
| 1A | 10 O.F. | 15 | Drl. | 259 | 100+ | | | Ca. | | C.Sal. | S. | " ; at barn |
| 1 | 10 O.F. | 16 | Brd. | 263 | 60 | 10 | 90 | S.& C. | | C.Sal. | D. | " ; at house |
| 1A | 10 O.F. | 16 | D. | 262 | 40 | 15 | | S.& C. | 18+ | C.Sal.Sul. | S. | " ; at barn |
| 1 | 10 O.F. | 17 | Drl. | 261 | 160 | | | Ca. | | H.C. | S. | " |
| 1 | 10 O.F. | 18 | Drl. | 262 | 50 | | | Ca. | 21M | H.C.Sul. | D.S. | Flowing well; measured 16/8/51 |
| 2 | 10 O.F. | 18 | Brd. | 265 | 30 | 6M | | S.& C. | | H.C.Sul. | N. | |
| 1 | 10 O.F. | 19 | Drl. | 264 | 87 | +20 | | Ca. | | H.C.Sul. | D. | " " ; excellent supply for R.C. Navy buildings |
| 1 | 10 O.F. | 20 | Drl. | 267 | 96 | | | N.(?) | | H.C.Sal. | D.S. | Sufficient; at house |
| 2 | 10 O.F. | 20 | D. | 267 | 24 | 5M | | S.& C. | | | N. | Vacant house |
| 1 | B.F.(R.F.) | 18 | Drl. | 287 | 99 | | 82 | G./Ot. | | H.C. | D. | Sufficient; at house |
| 2 | B.F.(R.F.) | 18 | D. | 288 | 25 | 9M | | C. | 16+ | | N. | Goes dry in winter; at house |
| 2A | B.F.(R.F.) | 18 | Drl. | 289 | 70 | 13 | | G./Ot. | | S.Sul. | D.S. | Sufficient; at barn |
| 1 | B.F.(R.F.) | 19 | Drl. | 288 | 80 | 16 | 60 | Ox. | | H.C. | D. | " ; at house |
| 2 | B.F.(R.F.) | 19 | Drl. | 292 | 90 | 15 | 76 | M. | | H.C. | D.S. | " ; at house |
| 2A | B.F.(R.F.) | 19 | D. | 290 | 30 | 14M | | C. | | H.C. | S. | " ; at barn |
| 3 | B.F.(R.F.) | 19 | Drl. | 293 | 60 | 40 | | M.(?) | 25+ | H.C. | D.S. | |
| 4 | B.F.(R.F.) | 19 | Drl. | 293 | 65 | 40 | | M.(?) | | H.I. | D. | Total hardness = 250 p.p.m. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | B.F.(R.F.) | 20 | Drl. | 292 | 110 | 25 | 25 | Ox. | 30+ | M.C. | D.S. | Never dry |
| 1 | B.F.(R.F) | 21 | Drl. | 296 | 80 | 20 | | Ox. | 45+ | M.C. | D.S. | " " |
| 2 | B.F.(R.F.) | 21 | Drl. | 290 | 68 | 15M | | G. | | H.C. | D | Previously a 25-foot, dug well |
| 1 | B.F.(R.F.) | 22 | D. | 285 | 28 | 16M | | C. | 23+ | H.C. | D.S. | Never dry |
| 2 | B.F.(R.F.) | 22 | Drl. | 297 | 100 | 50 | 70 | Ox. | 45+ | H.C. | D.S. | " " |
| 2A | B.F.(R.F.) | 22 | Drl. | 295 | 100 | 50 | 70 | Ox. | 45+ | H.C. | D.S. | " " |
| 1 | B.F.(R.F.) | 23 | D. | 259 | 13 | 9M | | C. | 16+ | H.C. | D. | On alluvial plain of Rideau R. |
| 2 | B.F.(R.F.) | 23 | D. | 259 | 12 | 7 | | C | | H.C. | D. | Sufficient; at house |
| 1 | B.F.(R.F.) | 24 | Drl. | 293 | 85 | 64 | 30 | Ox. | 6+ | H.C. | D.S. | " " " |
| 2 | B.F.(R.F.) | 24 | Drl. | 284 | 85 | 20 | 40 | Ox. | | H.C. | D. | Owned by Dept. of Transport |
| 3 | B.F.(R.F.) | 24 | Drl. | 287 | 37 | 15M | 30 | Ox. | 16+ | H.C. | D.S. | Previously a 30-foot dug well |
| 1 | B.F.(R.F.) | 25 | Drl. | 294 | 80 | 15 | | Ox. | 16+ | H.C. | D.S. | Never dry; at house |
| 2 | B.F.(R.F.) | 25 | D. | 310 | 18 | 14 | | S. | | H.C. | D. | Sufficient; at house. |
| 2A | B.F.(R.F.) | 25 | Drl. | 310 | 59 | 9 | 23 | Ox. | 26+ | H.C. | S. | " ; at barn. |
| 3 | B.F.(R.F.) | 25 | Drl. | 296 | 80 | 40 | 40 | Ox. | | H.C. | D. | " ; at house. |
| 3A | B.F.(R.F.) | 25 | D. | 296 | 21 | 11M | | C. | | H.C. | N. | Low in late summer |
| 4 | B.F.(R.F.) | 25 | Brd. | 288 | 15 | 8 | | C | | H.C. | D. | Goes dry; at cottage |
| 1 | B.F.(R.F.) | 26 | Drl. | 293 | 50 | 10 | | Ox. | | H.C. | D. | Sufficient; at house. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | B.R.(R.F.) | 26 | Drl. | 292 | 42 | 8 | 20 | Ox. | 25+ | H.C. | S. | Sufficient; at barn. |
| 1 | B.R.(R.F.) | 27 | Drl. | 301 | 80 | 21 | 40 | Ox. | 26+ | H.C. | D. | " ; at house |
| 1A | B.F.(R.F.) | 27 | Drl. | 304 | 25 | 24 | | S.C. | | H.C. | N. | Goes dry; at house. |
| [illegible] | B.F.(R.F.) | 27 | Drl. | 316 | 80 | 6M | 40 | Ox. | 25+ | H.C. | D.S. | Previously a 34-foot, dug well. |
| 1 | B.F.(R.F.) | 28 | Drl. | 292 | 42 | 28 | | Ox. | 26+ | H.C. | D.S. | Previously a dug well. |
| 1 | B.F.(R.F.) | 29 | Drl. | | 80 | 30 | 46 | Ox. | | H.C. | D. | Sufficient; at house. |
| 1 | B.F.(R.F.) | 30 | Drl. | 295 | 40 | 5 | | Ox. | 50+ | H.C. | D. | Never dry; at barn. |
| 2 | B.F.(R.F.) | 30 | D. | 306 | 20 | 5 | | C. | | H.C. | D. | Sufficient; at house. |
| 2A | B.F.(R.F.) | 30 | Drl. | 300 | 30 | 12 | 30 | G/Ox. | | S.C. | S. | Flowing well; at barn. |
| 3 | B.F.(R.F.) | 30 | Drl. | | 75 | 15 | 20 | Ox. | | H.C. | D. | Sufficient; at house. |
| 4 | B.F.(R.F.) | 30 | Drl. | | 73 | 20 | 20 | Ox. | 180 | H.C. | D. | " ; " |
| 5 | B.F.(R.F.) | 30 | D. | 288 | 32 | 18 | | C. | | H.C. | D. | " ; " |
| 6 | B.F.(R.F.) | 30 | D. | 291 | 24 | 10M | | C | | H.C. | D. | " ; " |
| 1 | 1R.F. | 9 | D.D.H. | 303 | 75 | 5 | 62 | Ca | 125 | H.C. | D. | |
| 1 | 1R.F. | 10 | D. | | | | | | | H.C. | D. | |
| 2 | 1 RF | 10 | Drl. | 295 | 85 | | 65 | Ox. | | H.C. | D.S. | Trouble with fine sand over bed-rock |
| 3 | 1 RF | 10 | Drl. | 298 | 92 | | 71 | Ox | | H.C. | D. | Very hard water |
| 1 | 1 RF | 12 | Drl. | 297 | 93 | 45 | | S. | | H.C. | D.S. | Water from fine sand under clay |
| 2 | 1 RF | 12 | Drl. | 262 | 82 | +6 | | G. | | H.C. | D. | Flowing well. Water from gravel under clay. |

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 RF | 13 | Drl. | 265 | 63 | | | G. | | H.C. | D. | Water from gravel under clay. |
| 2 | 1 RF | 13 | D. | 266 | 17 | 1 | | C.(?) | | H.Sul. | D. | On alluvial plain of Rideau River |
| 3 | 1 RF | 13 | D. | 262 | 12 | 6M | | C. | | H.Sul. | D. | " " " " " |
| 1 | 1 RF | 14 | D. | 265 | 28 | | | C.(?) | | H.C. | D.S. | Sufficient; at house. |
| 1 | 1 RF | 15 | D. | 263 | 38 | 10 | | C.(?) | | H.C. | D.S. | Sufficient for 3 families |
| 2 | 1 RF | 15 | Drl. | 266 | 65 | | | S. | | H.C. | D. | Water from sand/bedrock contact. |
| 3 | 1 RF | 15 | Drl. | 273 | 95 | +1 | 75 | S. | | H.C. | D. | Flows 45 g.p.h. in July 1951. 50°F water from sand/bedrock contact. |
| 4 | 1 R.F. | 15 | Drl. | 277 | 99 | | 75 | S. | | H.C. | D. | Flows at times: water from sand/bedrock contact. |
| 5 | 1 R.F. | 15 | Drl. | 279 | 111 | 30 | 104 | Ox. | | H.C. | D. | Sufficient. |
| 1 | 1 R.F. | 17 | Drl. | 289 | 98 | 21 | | Ox. | 45+ | S.Sul. | D.S. | " |
| 2 | 1 R.F. | 17 | D. | 286 | 25 | 10 | | C. | | H.C. | D. | Low in late summer: 53°F. |
| 3 | 1 R.F. | 17 | D. | 288 | 30 | 10 | | C. | | H.C. | D. | Goes dry in late summer. |
| 3A | 1 R.F. | 17 | Drl. | 285 | 120 | 12 | | Ox.(?) | 35+ | H.C. | D.S. | Sufficient; at barn. |
| 1 | 1 R.F. | 20 | Drl. | 301 | 60 | 13 | 55 | Ox. | 35+ | H.C. | D.S. | " |
| 1 | 1 R.F. | 21 | Drl. | 299 | 23 | 4M | | C. | 25+ | H.C. | S. | Never dry |
| 1 | 1 R.F. | 22 | D. | 303 | 16 | 5M | 16 | C. | | H.Sul. | D.S. | Water from clay/bedrock contact. |
| 2 | 1 R.F. | 22 | Drl. | 312 | 90 | | | Ma. | 27+ | H.C. | D.S. | Sufficient. |
| 2A | 1 R.F. | 22 | D. | 313 | 19 | 5M | | C | | H.C. | N. | |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 11R.F. | 23 | Drl. | 325 | 32 | 11M | 12 | Ox |  | H.C. | D.S. | Previously a 12-foot dug well. |
| 1A | 1R.F. | 23 | D. | 322 | 14 | 10 | 14 | C |  | H.Sul. | S | Water from clay/bedrock contact. |
| 1 | 1R.F. | 24 | Drl. | 340 | 60 | 40 | 0 | Ox. | 25+ | H.C. | D.S. | Water from large cracks in limestone. |
| 1 | 1R.F. | 25 | Drl. | 332 | 70 | 22 | 40 | Ox. | 20+ | H.C. | D.S. | Never dry; at barn. |
| 1A | 1R.F. | 25 | D. | 332 | 22 | 17M |  | C. |  | H.C. | N. | Dry during the winter. |
| 2 | 1R.F. | 25 | Drl. | 336 | 60 | 15 | 45 | Ox. | 20+ | H.C. | D.S. | Never dry. |
| 1 | 1R.F. | 26 | D. | 325 | 10 | 6M |  | C. |  | H.C. | D. | " " |
| 1A | 1R.F. | 26 | Drl. |  |  |  |  | Ox. | 12+ | H.C. | D.S. |  |
| 2 | 1R.F. | 26 | D. | 326 | 12 | 2M |  | S.T. |  | H.C. | D. | Supply steadily decreasing. |
| 2A | 1R.F. | 26 | Drl. | 328 | 53 | 13 | 20 | Ox. | 30+ | H.C.* | D.S. | Sufficient; 53°F. |
| 1 | 1R.F. | 27 | Drl. | 319 | 53 | 18 | 50 | Ox. | 20+ | H.C. | D.S. | Never dry. |
| 2 | 1R.F. | 27 | D. | 316 | 20 | 10M |  | C(?) | 20+ | H.C. | D.S. | " " |
| 3 | 1R.F. | 27 | Drl. | 320 | 89 | 16 | 3 | Ox. | 33+ | H.C. | D.S. | " " |
| 1 | 1R.F. | 28 | D. | 322 | 20 | 10 |  | C. | 13+ | H.C. | S. | " " |
| 1 | 1R.F. | 29 | D. | 328 |  | 5 |  | C.T. |  | H.C. | N. | Vacant house. |
| 1A | 1R.F. | 29 | D. | 306 | 12 | 2M |  | C. | 12+ | H.C. | S. | In field. |
| 2 | 1R.F. | 29 | Drl. | 314 | 45 |  | 45 | G. |  | H.C. | D.S. | Water from gravel/bedrock contact. |
| 1 | 1R.F. | 30 | D. | 311 | 22 | 5M |  | C. | 25+ | H.C. | D.S. | Never dry. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 1R.F. | 30 | D. | 318 | 15 | 10M | | C.T. | | H.C. | D | Never dry. |
| 2A | 1R.F. | 30 | D. | 326 | 30 | 15 | | C.T. | 20+ | H.C. | S | " " |
| 3 | 1R.F. | 30 | D. | | | | | C.T. | | H.C. | D | Sufficient; at house |
| 3A | 1R.F. | 30 | D. | 300 | 9 | 6M | | C. | | H.C. | S | " ; at barn. |
| 1 | 2R.F. | 9 | D. | 364 | 18 | | | S | | H.C. | D | Never dry |
| 2 | 2R.F. | 9 | D. | 365 | 33 | 6M | | S | | H.C. | D. | " " |
| 3 | 2R.F. | 9 | D. | 367 | 70 | 68 | | S. | | H.C. | D. | " "; deepest dug well |
| 1 | 2R.F. | 10 | D. | 371 | 45 | 43 | | S. | | H.C. | D. | Goes dry. |
| 2 | 2R.F. | 10 | D. | 371 | 45 | 43 | | G. | | H.C. | D. | Goes dry. |
| 3 | 2R.F. | 10 | D. | 372 | 45 | 37M | | S. | | H.C. | N. | |
| 1 | 2R.F. | 11 | D. | 386 | 68 | 56 | | S. | | H.C. | D. | Sufficient. |
| 2 | 2R.F. | 11 | D. | 387 | 70 | 55 | | S | | H.C. | D. | " |
| 3 | 2R.F. | 11 | Drl. | 380 | 65 | 40 | | Ox. | | H.C. | D | Never dry |
| 1 | 2R.F. | 12 | D. | 378 | 53 | 46M | | S. | | H.C. | D. | Sufficient. |
| 2 | 2R.F. | 12 | D. | 369 | 45 | | | | | | | Dry hole |
| 1 | 2R.F. | 15 | D. | 302 | 19 | 6M | | C.(?) | | H.C. | D. | Never dry |
| 2 | 2R.F. | 15 | D. | 354 | 62 | 56M | | S.(?) | | H.C. | D.S. | Sufficient |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2R.F. | 16 | Drl. | 358 | 101 | 36 | | S/C | | H.C. | D. | Never dry |
| 2 | 2R.F. | 16 | D. | 350 | 12 | 6M | | S/C | | H.C. | D | |
| 3 | 2R.F. | 16 | D. | 369 | 40 | 31M. | 38 | Ox. | | H.C. | D.S. | Sufficient; at house. |
| 3A | 2R.F. | 16 | D. | 367 | 40 | 35 | 38 | C. | 38+ | H.C. | S. | Water at clay/bedrock contact. |
| 1 | 2R.F. | 17 | D. | 341 | 9 | 3M. | | S./C. | | H.C. | S. | Never dry. |
| 1A | 2R.F. | 17 | D. | 344 | 9 | 6M | | S./C. | | H.C. | D. | " " |
| 1 | 2R.F. | 18 | D. | 299 | 16 | 5M | | C. | | H.C. | D. | " " |
| 1A | 2R.F. | 18 | Drl. | 300 | 65 | | | Ox. | 28+ | H.C. | D.S. | " " |
| 1 | 2R.F. | 19 | D. | 302 | 23 | 9M | | C. | | H.C. | N. | " " |
| 1 | 2R.F. | 20 | D. | 301 | 28 | 13M | | C. | | S.C. | D. | Sufficient; at house. |
| 1A | 2R.F. | 20 | Drl. | 298 | 70 | 6 | 50 | Ox. | 20+ | H.C. | S. | " ; at barn[3] |
| 1 | 2R.F. | 23 | D. | 313 | 14 | 7M | | S. | | H.C. | D. | " ; at house. |
| 1A. | 2R.F. | 23 | Drl. | 312 | 45 | +3 | 25 | Ma | | H.C. | S. | Flows practically all year round. |
| 1 | 2R.F. | 24 | Drl. | 323 | 50 | 20 | | Ox. | | H.C. | D. | Sufficient for cheese factory. |
| 2. | 2R.F. | 24 | Drl. | 341 | 45 | 20 | 20 | Ma (?) | | H.C. | D.S. | Previously a 20-foot dug well. |
| 3. | 2R.F. | 24 | D. | 346 | 29 | 19M | | C. | | H.C. | D. | Goes dry in late summer. |
| 3A | 2R.F. | 24 | Drl. | 344 | 60 | | | Ox.(?) | 25+ | H.C. | S. | Never dry; at barn |
| 1 | 2R.F. | 25 | Drl. | 331 | 103 | 21 | 24 | Ox. | 38+ | H.C. | D.S. | Previously a 24-foot dug well. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 2R.F. | 25 | D. | 351 | 35 | 18M | | C.T. | | H.C. | S. | Goes dry; at barn |
| 1 | 2R.F. | 26 | Drl. | 348 | 105 | | 85 | Ox. | 20+ | H.C. | D.S. | Never dry. |
| 1A | 2R.F. | 26 | D. | 330 | 20 | 6M | | C. | | H.Sul. | N. | |
| 1B | 2R.F. | 26 | D. | 325 | 25 | 18M | | C. | | H.Sul. | N. | |
| 2 | 2R.F. | 26 | Drl. | 325 | 46 | 6 | | S. | 25 | H.C. | D.S. | Previously a 12-foot, dug well |
| 2A | 2R.F. | 26 | D. | 323 | 12 | 3 | | S. | | H.C. | N. | Never dry. |
| 2B. | 2R.F. | 26 | D. | 324 | 10 | 0 | | S. | | H.C. | N. | " " |
| 2C | 2R.F. | 26 | D. | 323 | 10 | | | S | | H.C. | N. | Never dry; by the creek. |
| 1 | 2R.F. | 27 | D. | | | | | C. | | H.C. | D. | " " |
| 1 | 2R.F. | 29 | D. | 329 | 10 | 9 | | S | | H.C. | N. | Water from sand under clay. |
| 1A | 2R.F. | 29 | D. | 325 | 10 | 5 | 16 | S/Ox. | 15+ | H.C. | D.S. | Water from sand over Oxford. |
| 1B | 2R.F. | 29 | D. | 320 | 12 | 1 | | S | | H.C. | S. | Water from sand under clay. |
| 2 | 2R.F. | 29 | D. | 328 | 12 | 9 | | S.T.(?) | | H.C. | D. | Sufficient, at house. |
| 2A | 2R.F. | 29 | D. | 335 | 12 | 9 | | S.T.(?) | | H.C. | S | Never dry; at barn. |
| 2B | 2R.F. | 29 | D. | 336 | 15 | 10 | | S.T.(?) | | H.C. | S. | " " ; in field. |
| 2C | 2R.F. | 29 | D. | 336 | 14 | 9 | | S.T.(?) | | H.C. | N. | " " ; " " . |
| 3 | 2R.F. | 29 | D. | 325 | 16 | 5M | | S.T.(?) | | H.C. | N. | Sufficient; in field. |
| 1 | 2 R.F. | 30 | D. | 346 | 23 | 15M | | S.T. | 15+ | H.C. | S. | " ; at barn |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 2R.F. | 30 | D. | 334 | 15 | 9M | | S.T.(?) | 20+ | H.C. | D. | Low in late summer; at house |
| 2A | 2R.F. | 30 | D. | 228 | 6 | 1M | | C. | | H.Sul. | S. | Never dry; by road. |
| 1 | GORE R.F. | 8 | Drl. | | 490 | | 62 | G.& Ox. | | H.C. | N. | Water at 52 feet in gravel and at 79 & 245 feet in Oxford. |
| 1 | " | 14 | D. | 365 | 40 | 35 | | S. | 18+ | H.C. | D.S. | Never dry. |
| 1 | " | 15 | D. | 367 | 30 | | | | | S.C. | D. | " " |
| 2 | " | 15 | Spt. | 368 | 40 | 35M | | S. | | H.C. | D. | Goes dry. |
| 1 | " | 16 | D. | 370 | 45 | 8 | | S/C | | H.C. | D. | Never dry |
| 2 | " | 16 | D. | 368 | 28 | 21M | | S. | | S.C. | D. | " .. " |
| 1 | " | 25 | D. | 365 | 16 | 15 | | G. | 10+ | H.C. | D.S. | Sufficient |
| 1 | " | 26 | Drl. | 362 | 71 | 20 | 11 | Ox. | 12+ | H.C. | D.S. | Never dry |
| 1 | " | 30 | D. | 334 | 14 | 7M | | C. | | H.C. | D.S. | Sufficient |
| 1 | 3R.F. | 6 | D. | 305 | 18 | 9 | | S. | | H.C. | D.S. | Water from sand under clay. |
| 2 | 3R.F. | 6 | Drl. | 308 | 300 | | | B.(?) | | C.Sul. | D. | $H_2S$ from lower half of well. |
| 3. | 3R.F. | 6 | D. | 298 | 14 | | | G. | | H.C. | D. | Sufficient. |
| 4 | 3R.F. | 6 | D. | 298 | 4 | 3M | | C.F. | | H.C. | D. | " |
| 1 | 3R.F. | 7 | D. | 306 | 8 | 1 | | S. | | H.C. | D. | " |
| 2 | 3R.F. | 7 | Drl. | 327 | 131 | | | Ca.(?) | | H.C. | D. | Excellent supply; at house. |
| 2A | 3R.F. | 7 | Drl. | 327 | 129 | | | " | 30+ | C.Sul. | S. | Sufficient; at barn. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 3R.F. | 7 | D | 320 | 8 | | | | | | | Dry hole in clay till. |
| 1 | 3R.F. | 8 | D | 314 | 9 | 5 | | S | | S.C. | D | Never dry; at house. |
| 2 | 3R.F. | 8 | D | 304 | 2 | 1M | | S | | S.C. | D. | Goes dry; in house. |
| 3 | 3R.F. | 8 | D. | 314 | 6 | 5M | | S | | S.C. | D. | Sufficient (?) at house. |
| 1 | 3R.F. | 9 | D. | 321 | 14 | 6M | | C.T. | | S.C. | D.S. | Water from till/Oxford contact |
| 1A | 3R.F. | 9 | D. | 321 | 14 | 6 | 14 | C.T. | | S.C. | S. | " " " " " |
| 2 | 3R.F. | 9 | D. | 312 | 12 | 8M. | | S. | | H.C. | D. | Never dry; at house. |
| 3 | 3R.F. | 9 | D. | 317 | 16 | 5M. | | S.&C. | | H.C. | D. | " " |
| 1 | 3R.F. | 10 | D. | 311 | 5 | 3M | | " | | H.C. | D. | " "; in house. |
| 2 | 3R.F. | 10 | D. | 311 | 14 | 5 | | C. | | H.C. | D. | " "; " " |
| 3 | 3R.F. | 10 | D. | 317 | 7 | 4M | | S. | | S.C. | D. | Water from fine sand. |
| 4 | 3R.F. | 10 | Drl. | 316 | 115 | 5 | 95 | Ox.(?) | | H.C. | | Flows at times; water from gravel over Oxford and from Oxford. |
| 1. | 3R.F. | 11 | D. | 317 | 4 | 4 | | S. | | H.C. | D. | Goes dry; in house. |
| 1 | 3R.F. | 14 | D. | 369 | 41 | 37M | | S(?) | | | N(?) | |
| 1 | 3R.F. | 16 | Spt. | 329 | 10 | 3 | | S. | | S.C. | D. | Never dry; at house. |
| 2 | 3R.F. | 16 | Drl. | | | | | | | | D. | Limited information |
| 1 | 3R.F. | 17 | D. | 367 | 36 | 30 | | S | | H.C. | D. | Sufficient; at house. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 3R.F. | 17 | D. | 365 | 40 | 36 | | S | 65+ | H.C. | D.S. | Sufficient for 4 families; at barn |
| 1 | 3R.F. | 18 | D. | 356 | 30 | 28 | | G. | 25+ | H.C. | D.S. | Water from gravel/clay contact; at barn. |
| 2 | 3R.F. | 18 | D. | 352 | 19 | 5M | | S. | 12+ | H.C. | D.S. | Never dry. |
| 1 | 3R.F. | 19 | D. | 344 | 19 | 13 | | S. | | H.C. | D. | Water from sand/clay contact. |
| 1 | 3R.F. | 20 | D. | 358 | 40 | 35 | | S | 25+ | H.C. | D.S. | Never dry. |
| 1 | 3R.F. | 23 | Drl. | 372 | 81 | 35M | | Ox. | 100+ | H.C. | D.S. | Never dry. |
| 1 | 3R.F. | 24 | D. | 376 | 27 | 20M | | S. | 20+ | S.C. | D.S. | Sufficient. |
| 2 | 3R.F. | 24 | Drl. | 373 | 42 | | 42 | S. | | H.C. | D.S. | Water from sand/Oxford contact. |
| 1 | 3R.F. | 25 | Drl. | 387 | 80 | 30 | | S. | 25+ | H.C. | D.S. | Water from "running" sand;never dry. |
| 2 | 3R.F. | 25 | Drl. | 388 | 125 | | | G. | | H.C. | D. | Never dry; at school. |
| 1 | 3R.F. | 26 | Drl. | 351 | 49 | 20 | 9 | Ox. | 27+ | H.C. | D.S. | " " |
| 2 | 3R.F. | 26 | Drl. | 360 | 20 | 9 | 10 | Ox. | | H.C. | D. | previously a 10-foot, dug well |
| 3 | 3R.F. | 26 | Drl. | 384 | 60 | 33 | | G. | 32+ | H.C. | D.S. | Never dry. |
| 1 | 3R.F. | 27 | D. | 324 | 15 | 4M | | C. | 6+ | H.C. | D.S. | Sufficient. |
| 1 | 3R.F. | 28 | D. | 322 | 12 | 4M | | C. | 12+ | H.Sul. | S. | Water is greenish colour. |
| 1 | 3R.F. | 29 | D. | 338 | 30 | 15 | | S. | 6+ | H.C. | D.S. | Never dry; at barn. |
| 1 | 3R.F. | 30 | Drl. | 343 | 127 | 20 | 85 | Ox. | 37+ | H.C. | D.S. | Sufficient. |
| 2 | 3R.F. | 30 | Drl. | 339 | 85 | 22 | 55 | S. | 6+ | S.C. | D.S. | Water from sand/Oxford contact. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4R.F. | 6 | D. | 305 | 10 | 5 | | S.& C. | | S.C. | D. | Sufficient |
| 2 | 4R.F. | 6 | D. | 308 | | | | S. | | H.C. | D. | " |
| 3 | 4R.F. | 6 | D. | 303 | 12 | 5 | | S. | | H.C. | D. | " |
| 4 | 4R.F. | 6 | D. | 306 | 15 | 5M. | | S. | | S.C. | D. | " |
| 5 | 4R.F. | 6 | Drl. | | | | | Ca.(?) | 40+ | H.C. | D. | Sufficient for 2 families. |
| 6 | 4R.F. | 6 | D. | 328 | 32 | 20 | | G/C | | H.C. | D. | Goes dry during late summer. |
| 7 | 4R.F. | 6 | D. | 306 | | | | S. | | H.C. | D. | Sufficient. |
| 8 | 4R.F. | 6 | Drl. | 320 | 85 | 30M | None | G. | | H.C. | D. | Water from sand & gravel under clay; under considerable pressure. |
| 9 | 4R.F. | 6 | D. | | 35 | | | S. | | H.C. | D. | Sufficient. |
| 9A | 4R.F. | 6 | Spt. | | 32 | | | S. | | H.C. | N. | |
| 10 | 4R.F. | 6 | Drl. | 339 | 150 | 30 | 135 | Ca. | 1000 | C.Sul. | D. | " |
| 11 | 4R.F. | 6 | D. | 300 | 16 | 8 | | C. | | H.C. | D. | " |
| 12 | 4R.F. | 6 | D. | 303 | 12 | 7 | | S.& C. | | H.C. | D. | Sufficient. |
| 13 | 4R.F. | 6 | D. | 304 | 16 | 7M | | S/C | | H.C. | D. | Water at 12 feet. at sand/clay contact. |
| 14 | 4R.F. | 6 | D. | 298 | 17 | 12 | | S. | | H.C. | D. | Water at 12 feet; in sand under clay. |
| 1 | 4R.F. | 7 | D. | 297 | 10 | 6M | | S. | | H.C. | D. | Sufficient. |
| 2 | 4R.F. | 7 | D. | 325 | 20 | 10 | | C.T. | | H.C. | D. | " , at house. |
| 3 | 4R.F. | 7 | Drl. | | 300+ | | | B.(?) | | H.Sul. | D. | Sufficient for cemetary; too sulphurous for drinking purposes. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 4R.F. | 7 | Drl. | 328 | 120 | | None | G.(?) | | S.C. | D.S. | Sufficient |
| 5 | 4R.F. | 7 | Drl. | 320 | 118 | 40 | " | G. | | H.C. | D. | " ; at grocery store. |
| 6 | 4R.F. | 7 | Drl. | 320 | 120 | 17M | 98 | Ca.(?) | | H.C. | D. | Water at 117 feet in sand above Carlsbad. |
| 1 | 4R.F. | 8 | Drl. | 321 | 50 | 14 | None | S.& G. | | H.C. | D. | Water at 16 feet in sand and black gravel under clay. |
| 2 | 4R.F. | 8 | Drl. | 320 | 50 | | " | S.& G. | | H.C. | D. | Water at 16 feet in sand and black gravel under clay |
| 3 | 4R.F. | 8 | D. | 325 | 21 | 17 | | S | | H.C. | D. | Water at 17 feet in sand under clay |
| 4 | 4R.F. | 8 | D. | 323 | 18 | 15M | | S. | | H.C. | D. | Sufficient. |
| 5 | 4R.F. | 8 | D. | 321 | 17 | 15M | | S. | | H.C. | D. | " |
| 6 | 4R.F. | 8 | Drl. | 326 | 98 | 17M | 92 | Ca. | | H.cl. | D | Water at 97 feet in Carlsbad. |
| 7 | 4R.F. | 8 | Drl. | 312 | 32 | 17 | | G. | | S.C. | D. | Sufficient. |
| 8 | 4R.F. | 8 | D. | 311 | 23 | 19 | | S. | | H.C. | D. | Sufficient; at house. |
| 9 | 4R.F. | 8 | Drl. | 311 | 84 | 6M | | G. | | H.C. | D. | Water at 80 feet in black gravel. |
| 10 | 4R.F. | 8 | Drl. | 321 | 50 | 10 | | G. | | S.C. | D. | Water at 50 feet in black gravel. |
| 10A | 4R.F. | 8 | D. | 318 | 6 | | | S. | | H.C. | S. | Sufficient; at barn. |
| 11 | 4R.F. | 8 | D. | 314 | 15 | 5 | | S. | | S.C. | D.S | Goes dry; at house. |
| 12 | 4R.F. | 8 | D. | 314 | 6 | 4 | | S. | | S.C. | .D. | Sufficient; at house. |
| 13 | 4R.F. | 8 | D. | 312 | 10 | 6 | | S. | | S.C. | .D. | Never dry; " " |
| 14 | 4R.F. | 8 | D. | 311 | 10 | 4 | | S. | | S.C. | D. | " " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4R.F. | 9 | Drl. | 308 | 32 | 6 | | G. | | S.C. | D. | Water at 30 feet in gravel under clay. |
| 2 | 4R.F. | 9 | D. | 315 | 15 | 9 | | S. | | H.C. | D | Goes dry during late summer;at house. |
| 2A | 4R.F. | 9 | D. | 310 | 11 | 4M | | S. | | H.C. | D. | Sufficient. |
| 3 | 4R.F. | 9 | D. | 304 | 15 | 6M | | S. | | H.C. | D. | " |
| 4 | 4R.F. | 9 | D. | 302 | 12 | 7 | | S.& C. | | H.C. | D. | "; at house. |
| 4A | 4R.F. | 9 | D. | 301 | 12 | 7 | | S.& C. | | H.C. | S. | ", at barn. |
| 5 | 4R.F. | 9 | D. | | 110 | 5 | 87 | Bi(?) | | H.C. | D. | Pumping level = 91 feet at 25 I.G.M. |
| 1 | 4R.F. | 10 | Spt. | 303 | 40 | | | S. | | H.C. | I | Sufficient; at house. |
| 1A | 4R.F. | 10 | D. | 303 | 15 | | | S. | | H.C. | I | " ; in field; may be drilled. |
| 2 | 4R.F. | 10 | Spt. | 302 | 14 | 2 | | S. | | H.C. | D. | Water at 5 feet in sand under clay. |
| 3 | 4R.F. | 10 | Drl. | 302 | 39 | | 30 | Ca.(?) | | C.Sul. | D. | Sufficient. |
| 4 | 4R.F. | 10 | Drl. | 299 | 38 | 2 | None | S. | | H.Sul. | D. | Water from sand under clay. |
| 5 | 4R.F. | 10 | S.pt(?) | 301 | 25 | | | S. | | S.C | D. | Sufficient |
| 6 | 4R.F. | 10 | D. | 301 | 11 | 5 | | S.& G. | | H.C. | D. | Water from sand and gravel over clay. |
| 7 | 4R.F. | 10 | D. | 308 | 10 | 7M | | S. | | S.C. | D. | Sufficient |
| 8 | 4R.F. | 10 | D. | 301 | 7 | 4 | | S. | | | N. | Vacant house. |
| 1 | 4R.F. | 11 | D | 308 | 11 | 3M | | S. | | H.C. | D.S. | Sufficient. |
| 2 | 4R.F. | 11 | Spt. | 314 | 17 | | | S. | | H.C. | D. | Sufficient. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 4R.F. | 11 | D. | 314 | 15 | 4 | | S. | | H.C. | D.S. | Water at 15 feet in sand. |
| 4 | 4R.F. | 11 | D. | 316 | 13 | 7 | | S. | | H.C. | D. | Sufficient. |
| 5 | 4R.F. | 11 | Drl. | 313 | 125 | 12 | | Ca. | 18+ | H.C. | D.S. | " |
| 1 | 4R.F. | 12 | Drl. | | 60 | | | Ca. | | H.C. | D.S. | " ; at house. |
| 1A | 4R.F. | 12 | D. | 310 | 15 | 9 | | C.T. | | H.C. | S. | " ; at barn |
| 2 | 4R.F. | 12 | Drl. | | | | | Ca. | | | N(?) | |
| 1 | 4R.F. | 13 | D. | 304 | 10 | 8M. | | S. | | H.C. | D.S. | Sufficient. |
| 2 | 4R.F. | 13 | D. | 318 | 12 | 5M | | S(?) | | H.C. | D. | Sufficient. |
| 3 | 4R.F. | 13 | D. | 324 | 12 | 9M | | C.T. | | | N. | |
| 3A | 4R.F. | 13 | Drl. | 318 | 100 | 8 | | Ca. | | H.C. | D.S. | Previously a dug well; at barn. |
| 4 | 4R.F. | 13 | D. | 318 | 8 | 5M | 8 | C.T. | | H.C. | D.S. | Water at till/Carlsbad contact. |
| 5 | 4R.F. | 13 | D. | | 10 | | | S. | | H.C. | D.S. | Sufficient. |
| 1 | 4R.F. | 14 | D. | 320 | 14 | 87 | 3 | Ca. | | H.C. | D. | Water from 14 feet; from small crack in Carlsbad. |
| 2 | 4R.F. | 14 | D. | 330 | 14 | 10 | 14 | S-C.T. | | H.C. | D. | Water at 14 feet from till/ Carlsbad contact. |
| 2A | 4R.F. | 14 | D. | 330 | 17 | 11M | 17 | S-C.T. | 25+ | H.C. | S. | Water at 17 feet from till/ Carlsbad contact. |
| 1 | 4R.F. | 15 | D. | 332 | 14 | 10M | 14 | S.-C.T. | 18+ | H.C. | D.S. | Sufficient |
| 2 | 4R.F. | 15 | D. | 340 | 15 | 7M | | C.T. | | H.C. | D. | " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2A | 4R.F. | 15 | Drl. | | 86 | 18 | 35 | Ca. | 17+ | H.C. | D.S. | Sufficient. |
| 3 | 4R.F. | 15 | D.D.H. | 320 | 50 | 25 | 20 | Ma | | H.C. | D. | " ; at house. |
| 1 | 4R.F. | 16 | Drl. | 338 | 33 | 15 | | C.T. | 45+ | H.C. | S. | " ; at barn |
| 1A | 4R.F. | 16 | D. | 343 | 22 | 13M | | C.T. | | H.C. | N. | |
| 1B | 4R.F. | 16 | D. | 346 | 22 | 12M | | C.T. | | H.C. | N. | |
| 1C | 4R.F. | 16 | Drl. | 308 | 20 | +4M | | C.T. | 60 | S.C.☆ | S. | Flows 60 g.p.h.; Water probably from till/Carlsbad contact; 50°F. |
| 1 | 4R.F. | 17 | D. | 338 | 15 | 8 | | C.T. | | S.C. | D. | Never dry; at house. |
| 1A | 4R.F. | 17 | Drl. | 332 | 87 | 10 | | Ox. | 25+ | H.C. | D.S. | Previously a dug well; at barn. |
| 2 | 4R.F. | 17 | D. | 338 | 18 | 12 | | S.T. | | H.C. | D. | Sufficient; at house. |
| 2A | 4R.F. | 17 | D. | 337 | 7 | 0 | | S.T.(?) | 25+ | S.C. | S. | " ; at barn |
| 1 | 4R.F. | 18 | D. | 319 | 12 | 4 | | C.T. | 37+ | H.C. | D.S. | Never dry. |
| 1 | 4R.F. | 21 | Drl. | 319 | 60 | 30 | 16 | Ox. | | H.C. | D. | " " ; at house |
| 1A | 4R.F. | 21 | Drl. | 319 | 92 | 30 | 16 | Ox. | 22+ | H.C. | S. | " " ; at barn. |
| 1B | 4R.F. | 21 | Drl. | 320 | 70 | 30 | 17 | Ox. | | H.C. | D. | " " ; at milk house |
| 1 | 4R.F. | 22 | D. | 359 | 20 | 15 | | S. | | | | information incomplete. |
| 2 | 4R.F. | 22 | D. | 378 | 50 | 42M | | S.& G. | 27+ | H.C. | D.S. | Never dry. |
| 1 | 4R.F. | 23 | D. | 381 | 45 | 43 | | C.& G. | 13+ | H.C. | D.S. | " " |
| 2 | 4R.F. | 23 | Drl. | 339 | 35 | 12M | | Ox. | | H.C. | D.S. | Previously a 10 foot dug well. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4R.F. | 24 | D. | 345 | 30 | 10 | 30 | S.T. | 8+ | H.C. | D.S. | Water at 30 feet from till/Oxford contact; at house. |
| 1A | 4R.F. | 24 | D. | 344 | 30 | 4 | 30 | S.T. | 8+ | H.C. | S. | Water at 30 feet from till/Oxford contact; at barn. |
| 1B | 4R.F. | 24 | D. | 347 | 24 | | 24 | Ox. | | H.C. | N. | |
| 2 | 4R.F. | 24 | D. | | 120 | | | Ox. | | H.C. | S. | Sufficient. |
| 1 | 4R.F. | 25 | Drl. | 383 | 60 | | 0 | Ox. | 35+ | H.C. | D.S. | Never dry. |
| 2 | 4R.F. | 25 | Drl. | 388 | | | 0 | Ox. | | H.C. | D. | Sufficient. |
| 1 | 4R.F. | 26 | Drl. | 386 | 79 | 14M | 0 | Ox. | | H.C. | D. | " |
| 2 | 4R.F. | 26 | Drl. | 388 | 90 | 10 | | Ox. | 35+ | H.C. | D.S. | Previously a 10-foot,dug well |
| 1 | 4R.F. | 27 | Drl. | 383 | 100 | 10 | | Ox. | 35+ | H.C. | D.S. | Never dry |
| 2 | 4R.F. | 27 | Drl. | 385 | 72 | 35M | None(?) | S.& G. | | H.C. | D. | " " , at house. |
| 1 | 4R.F. | 28 | D. | 357 | 16 | 11M | | C.T. | | H.C. | D.S. | Sufficient; " " |
| 1A | 4R.F. | 28 | Drl. | 359 | 63 | | | Ox. | | H.C. | N. | |
| 1B | 4R.F. | 28 | D. | 354 | 13 | 9M | | C.T. | | H.C. | S. | Sufficient; in field |
| 2 | 4R.F. | 28 | Drl. | 359 | | | | | | H.C. | D. | Information incomplete;at church. |
| 2A | 4R.F. | 28 | Drl. | 357 | | | | | | H.C. | D. | " " " " |
| 1 | 4R.F. | 29 | D. | 348 | 7 | 4M | | C.T. | | H.C. | D. | Sufficient for 2 families;at store. |
| 2 | 4R.F. | 29 | D. | 353 | 26 | | 26 | C.T. | | H.cl. | D. | Water at 30 feet from till/Oxford contact; at house. |
| 2A | 4R.F. | 29 | Drl. | 356 | 50 | 12 | 26 | Ox. | 600 | H.C. | D.S. | Never dry; at barn. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 4R.F. | 29 | Drl. | 346 | 37 | 30M | 37 | C.T. | | H.C. | D. | Water at 30 feet from till/ Oxford contact. |
| 4 | 4R.F. | 29 | Drl. | 347 | 76 | | 6 | Ox. | | H.C. | D. | Sufficient; at house. |
| 4A | 4R.F. | 29 | D. | 347 | 16 | 12 | | C.T. | 12+ | H.C. | S. | Never dry; at barn. |
| 1 | 4R.F. | 30 | Drl. | 342 | 25 | | 8 | Ox. | | H.C. | D.S. | Sufficient; at house. |
| 2 | 4R.F. | 30 | D. | 341 | 19 | 3M | | C.T. | 14+ | H.C. | D.S. | Sufficient |
| 3 | 4R.F. | 30 | D. | 342 | 16 | 8 | | C.T. | | H.C. | D. | " ; at house |
| 4 | 4R.F. | 30 | Drl. | 339 | | | | Ox.(?) | | H.C. | D. | Sufficient for new school. |
| 5 | 4R.F. | 30 | Drl. | 339 | 16+ | 8M | | | | | N . | At old school |
| 1 | 5R.F. | 6 | D. | 281 | 15 | | 3 | Ca. | | H.C. | D.S. | Sufficient; at house |
| 1A | 5R.F. | 6 | D. | 277 | 15 | | 3 | Ca. | | H.Sul. | D.S. | " ; in field |
| 2 | 5R.F. | 6 | D. | 309 | 15 | | | S.(?) | | H.C. | D.S. | " ; at house |
| 2A | 5R.F. | 6 | D. | 308 | 15 | | | S.(?) | | H.C. | S. | " ; at barn |
| 3 | 5R.F. | 6 | D. | 309 | 25 | 18 | | S. | | S.C. | D.S. | " ; at house. |
| 3A | 5R.F. | 6 | D. | 302 | 18 | 8 | | S. | | S.C. | S. | " ; at barn |
| 1 | 5R.F. | 6 | Drl. | 286 | 145 | 7 | 2 | Ca. | | H.C. | D.S. | " |
| 2 | 5R.F. | 7 | D. | 305 | 10 | 6M | | S. | | S.C. | D. | Excellent supply; in house. |
| 2A | 5R.F. | 7 | D. | 309 | 11 | 9M | | S. | | S.C. | S. | Sufficient; at barn. |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5R.F. | 8 | D. | 301 | 15 | 5M. | | S. | | H.C. | D.S. | Sufficient; at barn |
| 2 | 5R.F. | 8 | Drl. | 289 | 60 | 15 | 4 | Ca. | | H.C. | D.S. | " ; at house. |
| 2A | 5R.F. | 8 | D. | 288 | 9 | 8M | | C.T.(?) | | H.C. | S. | " ; at barn |
| 3 | 5R.F. | 8 | D. | 305 | 5 | 1M | | S. | | S.C. | D.S. | " ; |
| 1 | 5R.F. | 9 | D. | 281 | 10 | 6M | | S. | | H.C. | D. | Several small springs from sand in area. |
| 1A | 5R.F. | 9 | D. | 284 | 8 | 6M | | S. | | H.C. | N. | At barn. |
| 2 | 5R.F. | 9 | D. | 304 | 7 | 5 | | S. | | H.C. | D.S. | Water boiled before drinking. |
| 3 | 5R.F. | 9 | D. | 283 | 6 | 4M. | | S. | | H.C. | N. | Vacant house. |
| 1 | 5R.F. | 10 | D. | 286 | 15 | 8M | | S. | | H.C. | D. | Sufficient; at house |
| 1A | 5R.F. | 10 | D. | 286 | 15 | 6M. | | S. | | | N. | |
| 2 | 5R.F. | 10 | D. | 307 | 10 | 8 | | S. | | S.C. | D. | Sufficient |
| 3 | 5R.F. | 10 | D. | 307 | 11 | 9M | | S. | | S.C. | D. | " |
| 4 | 5R.F. | 10 | D. | 299 | 6 | 5M. | | S. | | H.C. | D.S. | " |
| 5 | 5R.F. | 10 | D. | 300 | 6 | 5M | | C. | | H.C. | D.S. | Never dries. |
| 1 | 5R.F. | 11 | Drl. | 306 | 80 | 12 | | Ca. | | H.C. | D.S. | Water level never less than 30 feet from surface. |
| 1A | 5R.F. | 11 | D. | 306 | 11 | 9M | | S. | 75+ | S.C. | S. | Sufficient; at barn. |
| 1 | 5R.F. | 12 | D. | 301 | 11 | 5M | | S. | | H.I. | N. | |
| 1A | 5R.F. | 12 | D. | 300 | 12 | 9M | | S. | | H.C. | S. | Sufficient. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 5R.F. | 12 | D. | 300 | 12 | | | S.& C. | | S.C. | D. | Sufficient. |
| 1 | 5 R.F. | 13 | Drl. | 304 | 35 | 12 | | S. | | H.Sul. | D.S. | " |
| 2 | 5R.F. | 13 | D. | 299 | 9 | 5 | | S/C. | | H.C. | D.S. | Well is bottomed in clay. |
| 1 | 5R.F. | 14 | D. | 300 | 12 | 9M | | S. | | H.C. | D.S. | Sufficient. |
| 2 | 5R.F. | 14 | Drl. | 329 | 80+ | | | Ca. | | H.C. | D.S. | " |
| 1 | 5R.F. | 15 | D. | 292 | 12 | 8 | | S. | | S.C. | D. | " |
| 2 | 5R.F. | 15 | Spt. | 291 | 30 | | 80 | S.& C. | | H.C. | D. | Water at 80 feet from sand/ bedrock contact. |
| 3 | 5R.F. | 15 | D. | 339 | 15 | 12M | | S-C.T. | | H.I. | D. | Never dry. |
| 4 | 5R.F. | 15 | D. | 335 | 11 | 7M | | C. | | S.C. | D. | " " |
| 5 | 5R.F. | 15 | Drl. | 334 | 180 | 11M. | | Ca. | | H.C. | D.S. | Excellent well; at barn. |
| 6 | 5R.F. | 15 | D. | 343 | 16 | 13M | 7 | Ox. | | H.C. | D. | Goes dry annually during late summer. |
| 6A | 5R.F. | 15 | Drl. | 341 | 180 | 7M. | 7 | Ox. | | | N. | |
| 7 | 5R.F. | 15 | Drl. | 338 | 86 | 8 | 7 | Ca | | S.cl.☆ | D.S. | Water frequently cloudy; 49°F. |
| 8 | 5R.F. | 15 | Drl. | | | | | Ca. | | | | Information incomplete. |
| 9 | 5R.F. | 15 | Drl. | 293 | | | | Ca. | | | | " " |
| 1 | 5R.F. | 16 | D. | 350 | 14 | 9M | | S-C.T. | | H.C. | D. | Sufficient. |
| 2 | 5R.F. | 16 | Drl. | | 190 | | | Ca. | | H.C. | D.S. | " ; at barn. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 5R.F. | 16 | D. | 347 | 16 | | 10 | Ca. | | H.C. | D | Sufficient; at house. |
| 3A. | 5R.F. | 16 | Drl. | 348 | 100 | | 10 | Ca. | 31+ | H.C. | S. | " ; at barn. |
| 3B | 5R.F. | 16 | Drl. | 348 | 200 | | 10 | Ca. | 31+ | H.C. | S. | " ; at barn. |
| 1 | 5R.F. | 17 | D. | 343 | 10 | 4 | | C.T.(?) | | S.C. | D.S. | " |
| 1 | 5R.F. | 18 | D. | 315 | | | | C.T | | S.C. | D. | Never dry; at house. |
| 1 | 5R.F. | 20 | Drl. | 322 | 50+ | | | Ox. | | H.C. | D. | Goes dry during late summer. |
| 1A. | 5R.F. | 20 | Drl. | 323 | 75 | | | Ox. | | H.C. | S. | Sufficient; at barn. |
| 1 | 5R.F. | 21 | Drl. | 309 | 90 | 0 | 4 | Ox. | | H.C. | D.S. | Insufficient supply at 25 feet. |
| 2 | 5R.F. | 21 | Drl. | 321 | 26 | 10 | 4 | Ox. | | H.C. | D.S. | Flowed when first drilled. |
| 1 | 5R.F. | 23 | D. | 320 | 28 | 0 | 4 | Ox. | | S.cl. | N. | |
| 2 | 5R.F. | 23 | Drl. | 313 | 57 | | | Ma.(?) | 19+ | H.C. | D.S. | Sufficient. |
| 1 | 5R.F. | 24 | Drl. | 341 | 30 | | 2 | Ox. | | H.C. | D. | Soft water when first drilled; limited supply. |
| 2 | 5R.F. | 24 | Drl. | 385 | 75 | | 15 | Ox. | 49+ | H.C. | D.S | Never dry; at house. |
| 1 | 5R.F. | 25 | Drl. | 392 | 75 | | 11 | Ox. | | H.C. | D. | Sufficient. |
| 1A | 5R.F. | 25 | D. | 388 | 50 | | | C.T.(?) | | H.C. | S. | " |
| 2 | 5R.F. | 25 | Drl. | 397 | 57 | 7 | 2 | Ox. | | H.C. | D. | Limited supply. |
| 3 | 5R.F. | 25 | D. | 393 | 5 | 1 | 5(?) | C.T.(?) | | H.C. | D. | Sufficient. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5R.F. | 28 | Drl. | 362 | 97 | 20 | 2 | Ox. | | H.C. | D. | Sufficient. |
| 2 | 5R.F. | 28 | D. | 374 | 10 | 7 | | S.T. | | S.C. | D. | " |
| 2A | 5R.F. | 28 | Drl. | | 148 | | | Ox. | | S.C. | D.S. | " |
| 2B | 5R.F. | 28 | Spr. | | | 0 | 0 | Ox. | | H.C. | D. | In field. |
| 3 | 5R.F. | 28 | Drl. | 356 | 32 | 7 | 6 | Ox. | | H.C. | D. | Sufficient. |
| 1 | 5R.F. | 29 | Drl. | 349 | 44 | 6M | 6 | Ox | | H.C. | D. | Water at 40 feet in Oxford. |
| 2 | 5R.F. | 29 | D. | 359 | | | | C.T. | | H.C. | N. | |
| 3 | 5R.F. | 29 | Drl. | 341 | 28 | 6 | 2 | Ox. | 6+ | H.C. | D.S. | Sufficient. |
| 4 | 5R.F. | 29 | Spr. | 337 | 0 | 0 | | C.T. | | H.C. | D. | Flow decreasing in last year. |
| 5 | 5R.F. | 29 | Drl. | 343 | 34 | 4 | | G. | | H.C. | D. | Sufficient. |
| 6 | 5R.F. | 29 | Spr. | 339 | 4 | 0 | | C.T. | 6+ | H.C. | D.S. | " |
| 1 | 5R.F. | 30 | D. | 343 | 13 | 7M | | C.T. | | H.C. | D.S. | " |
| 2 | 5R.F. | 30 | D. | 339 | 25 | 15 | 15 | C.T. | 17+ | H.C. | D.S. | Blasted 10 feet into Oxford. Water at 15 feet from till/Oxford contact. |
| 2A | 5R.F. | 30 | Drl. | 338 | 15 | | 5 | | | | | Dry hole |
| 2B | 5R.F. | 30 | D. | | | | | | | H.C. | S. | Information incomplete; in field. |
| 1 | 6R.F. | 1 | D | 255 | 15 | 11M | | S./C. | 12+ | H.C. | D.S. | Well is bottomed on clay. |
| 1 | 6R.F. | 2 | D. | 253 | | | | S. | | H.C. | D. | Never dries |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 6R.F. | 2 | D. | 262 | 18 | 10M | | C.(?) | | H.C. | D | Sufficient |
| 3 | 6R.F. | 2 | Drl. | 248 | | | | Ca. | | | D.S. | Information incomplete. |
| 1 | 6R.F. | 3 | D. | 243 | 13 | 12M | | C.(?) | | H.C. | D. | Sufficient. |
| 2 | 6R.F. | 3 | Drl. | 237 | 33+ | 12M | | C.(?) | | H.C. | D. | " ; at house. |
| 3 | 6R.F. | 3 | D. | 255 | 25 | 8M | | S. | | H.C. | D. | " ; at cemetery. |
| 4 | 6R.F. | 3 | D. | 255 | 14 | 7M. | | S/C | | | N. | Vacant house |
| 5 | 6R.F. | 3 | Drl. | 251 | 65 | 40 | 40 | Ca | | S.C. | D. | Water partly from drift. |
| 5A | 6R.F. | 3 | Drl. | 253 | 372 | 40 | 40 | Ca. | | S.Min. | D.S. | Constant water level; at barn. |
| 1 | 6R.F. | 4 | Drl. | 237 | 80 | 15 | 20 | Ca. | 25+ | Sal.Sul.C.. | D.S. | Considerable inflammable gas in well. |
| 2 | 6R.F. | 4 | Drl. | 236 | 67 | 12 | 20 | Ca. | | S.Sul.Cl. | D. | Sufficient for house and garage. |
| 3 | 6R.F. | 4 | Drl. | 260 | 58 | 15 | 30 | Ca. | | S.C. | D. | Sufficient; at house. |
| 3A | 6R.F. | 4 | Drl. | 259 | 96 | | 19 | Ca. | | H.C. | S. | " ; at barn. |
| 1 | 6R.F. | 5 | Drl. | 231 | 36 | | 30 | Ca. | | S.C. | D. | Water at 36 feet in Carlsbad. |
| 2 | 6R.F. | 5 | Drl. | 232 | 80 | 12 | 35 | Ca. | | S.Min. | D. | " " 80 " " " |
| 3 | 6R.F. | 5 | Drl. | 232 | 80 | 12 | 35 | Ca. | | S.Min. | D. | " " 80 " " " |
| 4 | 6R.F. | 5 | D. | 229 | 16 | 6M. | | S. | | H.C. | D. | Sufficient. |
| 1 | 6R.F. | 6 | D. | 225 | 18 | 16 | | C. | | H.C. | D. | Goes dry; at house. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 6R.F. | 6 | Drl. | 223 | 25 | 2 | 25 | C | | S.C. | D.S. | Water at 25' from clay/Carlsbad contact; considerable inflammable gas in well. |
| 1 | 6R.F. | 7 | D. | 252 | 20 | 16 | | C. | | S.C. | D. | Sufficient. |
| 1A | 6R.F. | 7 | Drl. | 255 | 150 | 20 | | Ca. | 540 | H.Sul. | S. | " ; at barn. |
| 2 | 6R.F. | 7 | Drl. | 251 | 108 | 26 | None | G. | 16+ | S.C. | D. | Water at 108 feet in gravel beneath clay; Considerable inflammable gas in well. |
| 3 | 6R.F. | 7 | D. | 255 | 22 | 9M | | C. | | H.C. | D. | Sufficient. |
| 4 | 6R.F. | 7 | D. | 275 | 14 | 4 | 4 | Ca. | | H.C. | D.S. | Never dry; excellent well. |
| 1 | 6R.F. | 8 | Drl. | 276 | 140 | | 14 | Ca. | | H.Sul. | D.S. | " " ; " " |
| 2 | 6R.F. | 8 | D. | 273 | 18 (?) | | | C. | | S.C. | D. | Sufficient for 2 families. |
| 2A. | 6R.F. | 8 | Drl. | 275 | | | | | | C.Sal. | S. | At barn. |
| 1 | 6R.F. | 9 | D. | 261 | 8 | 6 | | S. | | H.C. | D. | Sufficient; at house. |
| 1A | 6R.F. | 9 | D. | 262 | 12 | 5M. | | S. | | H.C. | G. | " ; in field |
| 2 | 6R.F. | 9 | D. | 264 | 17 | 9M | | S. | | H.C. | D. | " |
| 3 | 6R.F. | 9 | D. | 258 | 20 | 15 | | C. | | H.C. | D. | " ; at house. |
| 3A | 6R.F. | 9 | Drl. | 257 | 165 | 9 | 165 | G. | | H.C.* | D.S. | Water from gravel beneath clay; 47°F. Water under strong pressure. |
| 4 | 6R.F. | 9 | D. | 285 | 18 | 4M | | S. | | H.C. | S. | Sufficient; in field. |
| 1 | 6R.F. | 10 | D. | 257 | 20 | 7M | | C. | | H.C. | D.S. | " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 6R.F. | 10 | D. | 260 | 16 | 12 | | C | | H.C. | D. | Low during fall and winter. |
| 3 | 6R.F. | 10 | Drl. | 261 | 166 | 4 | 162 | G. | | S.C. | D. | Water at 160+ feet from gravel above Carlsbad; very little gravel encountered. |
| 1 | 6R.F. | 11 | D. | 264 | | | | C. | | H.C. | D. | Goes dry; at house. |
| 1A | 6R.F. | 11 | Drl. | 259 | 164 | | | G. | | C.Sal. | S. | Water from gravel beneath clay; too saline for domestic use; at barn. |
| 2 | 6R.F. | 11 | D. | | | | | C. | | | | Information incomplete. |
| 2A | 6R.F. | 11 | Drl. | 262 | 149 | | | G. | | C.Sal | S. | Water from gravel beneath clay; at barn. |
| 1 | 6R.F. | 12 | Drl. | 259 | 209 | 6 | 157 | G. | 25+ | S.C.Sal.✡ | D.S. | Water at 120 feet from gravel beneath clay; 50°F; at barn. |
| 2 | 6R.F. | 12 | Drl. | 286 | | | | G(?) | | H.C. | D.S. | Sufficient; at barn. |
| 3 | 6R.F. | 12 | D. | 258 | 24 | 5 | | C. | | H.C. | D. | " ; at house. |
| 3A | 6R.F. | 12 | Drl. | 258 | 178 | 7 | 138 | Ca. | 18+ | C.Sal.Sul. | S. | Water probably both from gravel & Carlsbad; considerable inflammable gas present; at barn. |
| 1 | 6R.F. | 13 | D. | 297 | 10 | 6 | 80 | S./C. | | S.C. | D.S. | Well is bottomed in clay; at house |
| 1A | 6R.F. | 13 | D. | 296 | 12 | 7 | 80 | S./C. | | H.C. | B. | " " " " " ; at barn. |
| 1 | 6R.F. | 14 | D. | 268 | 15 | 8 | | S. | | | N. | |
| 1A | 6R.F. | 14 | Drl. | 270 | 180 | | | G.(?) | | Sal.C | N. | Water too saline for domestic use. |
| 1 | 6R.F. | 15 | D. | 273 | 14 | 5 | | G.& C. | | S.C. | D. | Sufficient. |
| 1A | 6R.F. | 15 | D. | 273 | 7 | 3M. | | G.& C. | | S.C. | S. | " |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 6R.F. | 15 | D. | 293 | 12 | 8M. | | S./C | | H.C. | D. | Well is bottomed in clay; at house. |
| 2A | 6R.F. | 15 | D. | 291 | 10 | 4M | | S./C. | | H.C. | S. | " " " " " ; at barn. |
| 3 | 6R.F. | 15 | D. | 293 | 14 | 10 | | S. | | S.C. | D.S. | Sufficient. |
| 4 | 6R.F. | 15 | D. | 288 | 7 | 5 | | S. | | H.C. | D. | " |
| 5 | 6R.F. | 15 | D. | 288 | | | | S. | | | | Information incomplete. |
| 1 | 6R.F. | 16 | D. | 299 | 7 | 6M. | | S. | | H.C. | D.S. | Sufficient. |
| 2 | 6R.F. | 16 | D. | 273 | 14 | 10 | | C. | | H.C. | D. | Goes dry; at house. |
| 2A | 6R.F. | 16 | Drl. | 271 | 80 | | | G. | | Sal.C. | D.S. | Water from gravel beneath clay; at barn. |
| 1 | 6R.F. | 17 | D. | 297 | 14 | 9 | | S. | | S.C. | D.S. | Sufficient. |
| 2 | 6R.F. | 17 | D. | 297 | 9 | | | S./C. | | H.C. | D. | Well is bottomed with clay |
| 3 | 6R.F. | 17 | Drl. | 273 | 100+ | 7M. | | | | | N. | |
| 1 | 6R.F. | 18 | D. | 277 | 13 | 7M. | | S. | | H.cl | D. | Sufficient; at house. |
| 1A | 6R.F. | 18 | D. | 277 | 7 | 5M | | S. | | H.C. | S. | " |
| 1 | 6R.F. | 20 | D. | 281 | 10 | 8M. | | S. | | H.C. | D. | " |
| 1 | 6R.F. | 21 | D. | 280 | 13 | 6M. | | S.(?) | | H.cl. | D.S. | " |
| 2 | 6R.F. | 21 | D. | 275 | 10 | 6M. | | S | | | N. | " |
| 3 | 6R.F. | 21 | D. | 273 | 12 | 9 | | S. | | H.C. | D.S. | " ; at house. |
| 3A | 6R.F. | 21 | Drl. | 277 | 80 | | | G. | | Min.C. | S. | Water from gravel under clay; at barn. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3B | 6R.F. | 21 | D. | 277 | 12 | 9 | | S. | | H.C. | D.S. | Sufficient; at barn. |
| 1 | 6R.F. | 22 | D. | 286 | 10 | 5M | | S. | | H.C. | N. | In field |
| 1 | 6R.F. | 23 | D. | 276 | 12 | 7M | | S. | | S.cl | N. | At house. |
| 1A | 6R.F. | 23 | D. | 274 | 9 | 6M | | S. | | H.C. | D.S. | Sufficient; at barn. |
| 2 | 6R.F. | 23 | Drl. | 272 | 104 | 12 | 65 | Ca. | | S.cl. | S. | Water at 104 feet from Carlsbad. |
| 2A | 6R.F. | 23 | D. | 275 | 11 | 8M | | S. | | H.C. | D. | Goes dry during late summer; at house. |
| 3 | 6R.F. | 23 | D. | 285 | 12 | 8M | | | | H.C. | D. | " " " " " ; at house. |
| 3A | 6R.F. | 23 | D. | 285 | 11 | 9M | | G.& C | 10+ | H.C. | S. | " " " " " ; at barn. |
| 3B | 6R.F. | 23 | D. | 287 | 12 | 7M | | S. & C. | | H.C. | S. | Sufficient; in field. |
| 1 | 6R.F. | 24 | D. | 287 | 9 | 7M | | S.& C. | | H.C. | D. | " ; at house. |
| 1A | 6R.F. | 24 | D. | 287 | 5 | 4M | | S.C& C. | | H.C. | S. | " ; at barn. |
| 2 | 6R.F. | 24 | D. | 268 | 7 | 6M | | S. | | H.C. | D. | " ; |
| 1 | 6R.F. | 26 | Drl. | 269 | 85 | | | S. | | H.C. | D.S. | " |
| 2 | 6R.F. | 26 | D. | 301 | 7 | | | | | | | Dry well in clay till (?) |
| 1 | 6R.F. | 27 | Drl. | 268 | 125(?) | | | | | Sal.C. | D.S. | Excellent supply. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2. | 6R.F. | 27 | D. | 326 | 13 | 7M. | | C.T. | | | N | Vacant house. |
| 1 | 6R.F. | 28 | Drl. | 268 | 106 | 2 | 96 | Ca. | | H.C. | D.S. | Water at 106 feet in Carlsbad. |
| 2 | 6R.F. | 28 | Drl. | 268 | 97 | | 97 | G. | | H.C. | D.S. | Water in gravel above Carlsbad. |
| 1<br>1 | 6R.F. | 30 | D. | 315 | 14 | | | C.T. | | H.C. | D. | Low in late summer; at house. |
| 1A | 6R.F. | 30 | D. | | 7 | | | C.T. | | H.C. | S. | Sufficient; in field. |

Community of Cyrville

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10.F. | 26 | Drl. | 222 | 140+ | 3 | | Bi | | M.Sul. | D. | Cloudy at times. |
| 2 | 2 O.F. | 26 | D. | 224 | 10 | 3M | 13 | C./Bi. | | H.C. | D. | Water at contact of clay and Billings. |
| 3 | 1 O.F. | 26 | Drl. | 227 | | | | Bi. | | | | Limited information. |
| 4 | 1 O.F. | 26 | Drl. | 227 | 45 | | 20 | Bi. | | H.Sul. | D. | Water not used for drinking |
| 5 | 2 O.F. | 27 | D. | 226 | | | | Bi. | | H.Sul. | D. | Sufficient supply. |
| 6 | 1 O.F. | 26 | Drl. | 230 | 94 | 9 | | Bi. | | M.C. | D | " " |
| 7 | 2 O.F. | 27 | Drl. | 226 | 72 | 12 | 20 | Bi. | | H.C. | D. | " " |
| 8 | 2 O.F. | 27 | Drl. | 227 | 68 | 15 | 14 | Bi. | | H.C. | D. | Excellent supply. |
| 9 | 2 O.F. | 26 | D. | 225 | 7 | | 2 | Bi. | | H.C. | D. | Goes dry during late summer. |
| 10 | 1 O.F. | 26 | Drl. | 227 | 55 | 11M. | 30 | Bi. | | S.C. | D. | Sufficient supply. |
| 11 | 2 O.F. | 26 | Drl. | 231 | | | | Bi. | | H.C. | D. | " " |
| 12 | 2 O.F. | 26 | D. | 230 | 9 | 4M | 9 | C./Bi. | | H.C. | D. | Goes dry during late summer |
| 13 | 2 O.F. | 27 | Drl. | 288 | 85 | 4 | | Bi. | | H.C. | D. | Sufficient supply. |
| 14 | 2 O.F. | 27 | D. | 227 | | | 5 | Bi. | | H.C. | D. | " " |
| 15 | 2 O.F. | 27 | Drl. | 228 | 110 | 15 | | Bi. | | S.C. | D. | Excellent supply. |
| 16 | 2 O.F. | 27 | D. | 226 | 16 | 4M. | 16 | C./Bi. | | H.C. | D. | Water from contact of clay and Billings; low in late summer. |
| 17 | 1 O.F. | 26 | Drl. | 229 | 175 | | 22 | Bi. | | H.C. | D. | Sufficient supply. |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 1 O.F. | 26 | Drl. | 230 | 150 | | 20 | Bi. | | M.C. | D. | Sufficient supply. |
| 19 | 2 O.F. | 27 | Drl. | 228 | 70 | | 13 | Bi | | H.C. | D. | " " |
| 20 | 2 O.F. | 27 | Drl. | 229 | | | | Bi. | | H.C. | D. | Reported as capable of yielding 1800 G.P.H. |
| 21 | 1 O.F. | 26 | Drl. | 224 | 35 | 2 | 4 | Bi. | | H.C. | D. | Sufficient for 5 families. |
| 22 | 2 O.F. | 26 | Drl. | 219 | 55 | 2 | 6 | Bi. | | M.Sul. | D. | Sufficient supply. |
| 23 | 1 O.F. | 26 | Drl. | 224 | 41 | | 6 | Bi. | | H.Sul. | D. | " " |
| 24 | 2 O.F. | 26 | Drl. | 224 | 43 | | | Bi. | | H.Sul. | D. | " " |
| 25 | 2 O.F. | 27 | Drl. | 227 | 40 | 8 | 6 | Bi. | | H.C. | D. | " " |
| 26 | 2 O.F. | 26 | D. | 229 | 11 | | 11 | C./Bi | | H.C. | D. | Water from contact of clay and Billings. |
| 26A | 2 O.F. | 26 | Drl. | 229 | 100 | 2 | | Bi. | | H.C. | D. | Sufficient supply. |
| 26B | 2 O.F. | 26 | D. | 233 | 12 | 2 | 12 | C./Bi | | H.C. | G. | Water from contact of clay and Billings. |
| 27 | 2 O.F. | 26 | D. | 234 | 20 | 15 | 9 | Bi. | | H.C. | D.G. | Low during late summer |
| 28 | 2 O.F. | 27 | Drl. | 227 | 67 | 4 | | Bi. | | H.C. | D. | Sufficient supply. |
| 29 | 2 O.F. | 26 | Drl. | 227 | 75 | | | Bi. | | M.C. | D. | " " |
| 30 | 2 O.F. | 26 | Drl. | 228 | 65 | 4 | 15 | Bi. | | H.C. | D. | " " |
| 31 | 2 O.F. | 26 | Drl. | 230 | 104 | | | Bi. | | S.C. | D. | Insufficient Supply. |
| 32 | 2 O.F. | 26 | D. | 227 | 9 | 4M | | C./Bi. | | H.C. | D.G. | Goes dry during late summer. |

Community of Cyrville

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 1 O.F. | 26 | D. | 227 | 13 | 3M. | 6 | Bi. | | H.C. | D. | Low during late summer. |
| 33A | 1 O.F. | 26 | D. | 229 | 33 | 2M | 7 | Bi. | | H.C. | G. | Sufficient supply. |
| 34 | 1 O.F. | 26 | Drl. | 207 | 75 | | | Bi. | | M.C. | D. | " " |
| 35 | 2 O.F. | 27 | Drl. | 225 | 75+ | | 6 | Bi. | | H.Sal. | D. | " " |
| 36 | 1 O.F. | 26 | Drl. | 227 | | | | Bi. | | H.C. | D. | " " |
| 37 | 2 O.F. | 27 | D. | 226 | 20+ | 6 | 20+ | C./Bi. | | H.C. | D. | Sufficient for 4 families. |
| 38 | 2 O.F. | 26 | Drl. | 225 | 38 | | | Bi. | | H.Sul. | D. | Low during late summer. |
| 39 | 2 O.F. | 26 | D. | 233 | 17 | 13 | 17 | C./Bi. | | H.C. | D. | Water from contact of clay and Billings. |
| 40 | 2 O.F. | 27 | Drl. | 226 | 76 | 9 | 6 | Bi. | | H.C. | D.G. | Sufficient supply |
| 41 | 2 O.F. | 27 | D. | 225 | 9 | 4M | 6 | Bi | | H.cl. | D. | Goes dry during late summer |
| 42 | 2 O.F. | 27 | Drl. | | 100+ | 10M | | Bi. | | H.Sal. | D. | Sufficient supply. |
| 43 | 2 O.F. | 26 | Drl. | 231 | 74 | | 5 | Bi. | | H.C. | D. | Sufficient for 3 families. |
| 44 | 2 O.F. | 26 | Drl. | 227 | 35 | 4M. | | Bi. | | H.C. | D.G. | Sufficient supply. |
| 45 | 2 O.F. | 26 | D. | 231 | | | | Bi. | | H.C. | D. | " " |
| 46 | 2 O.F. | 26 | Drl. | 230 | 130 | | | Bi. | | M.C. | D.G. | " " |
| 47 | 2 O.F. | 26 | D. | 228 | | | | C./Bi. | | H.C. | D. | " " |
| 48 | 2 O.F. | 26 | D. | 227 | | | | C./Bi. | | H.C. | D. | Low during late summer. |

Community of Cyrville

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 49 | 2 | O.F. 27 | Drl. | 228 | 100 | 4 | 20 | Bi. | | H.C. | D. | Sufficient supply. |
| 50 | 2 | O.F. 27 | Drl. | 229 | 100+ | | | Bi. | | H.Sul. | D. | " " |
| 51 | 1 | O.F. 26 | Drl. | 227 | 56 | 6M. | 18 | Bi. | | H.C. | D. | " " |
| | | Village of Orleans | | | | | | | | | | |
| 1 | 1 | O.F. 2 | Spr. | 193 | 8M | 0 | 8(?) | C. | | S.Sul. | D. | Dug out spring; strong hydrogen sulphide gas odour |
| 2 | 1 | O.F. 2 | Brd. | 209 | 21 | 7M | 21 | C/Ox. | | H.C. | D.S. | Excellent supply. |
| 2A | 1 | O.F. 2 | Brd. | 209 | 11 | 2M | 28 | S.& C. | | H.C. | N. | |
| 3 | 2 | O.F. 1 | D. | 226 | 15 | 5M | | C. | | M.C. | D. | Sufficient |
| 4 | 2 | O.F. 1 | D. | 221 | 13½ | 3M | | C. | | M.C. | D. | Located at base of bluff. |
| 5 | 1 | O.F. 3 | Brd. | 207 | 67 | | 67 | C./Ox. | | S.C. | D. | Sufficient |
| 6 | 2 | O.F. 1 | D. | 217 | 10 | 2M. | | | | M.C. | D. | Low in late summer. |
| 7 | 1 | O.F. 3 | D. | 214 | | | | C. | | H.Sal. | D. | Sufficient |
| 8 | 1 | O.F. 1 | D. | 219 | | | | C. | | H.Cl. | N. | |
| 8A | 1 | O.F. 1 | Drl. | 219 | | 6M | | C. | | H.Cl. | S. | " |
| 9 | 1 | O.F. 1 | D. | 216 | 14 | 3M | | C. | | S.C. | D. | |
| 9A | 1 | O.F. 1 | Brd. | 216 | 27 | 4M. | | C. | | C.Sul. | N. | " |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 2 | O.F. 1 | Brd. | 220 | 40(?) | 8 | | C. | | C.Sal. | D. | Sufficient for garage. |
| 11 | 1 | O.F. 3 | D. | 206 | 9 | 5M. | | C. | | H.C. | N. | |
| 11A | 1 | O.F. 3 | Brd. | 207 | 45 | | 45 | G. | | M.Sal. | D. | Water from gravel beneath clay. |
| 11B | 1 | O.F. 3 | D. | 199 | 6 | 2M | | C. | | S.Sul. | D. | Sufficient. |
| 11C | 1 | O.F. 3 | Brd. | 201 | 41 | 8M | 41 | C/Ox. | | S.Sul. | D. | Water from clay/Oxford contact. |
| 12 | 2 | O.F. 3 | D. | 218 | 10 | 2M. | | C. | | H.C. | D. | Sufficient for one family. |
| 12A | 2 | O.F. 3 | Brd. | 217 | 57 | 2M. | | C.(?). | | H.C. | D. | Sufficient. |
| 13 | 1 | O.F. 1 | Brd. | 211 | 20+ | | | C. | | S.C. | D. | Excellent supply. |
| 14 | 1 | O.F. 2 | Brd. | 218 | 32½ | 4M. | | C. | | H.C. | D. | Sufficient. |
| 15 | 1 | O.F. 1 | D. | 217 | | | | C. | | H.cl. | D | " |
| 16 | 2 | O.F. 1 | D. | 210 | 25+ | 12 | | C. | | H.C. | D. | " |
| 17 | 1 | O.F. 2 | Drl. | 223 | 64 | | 64 | C./Ox. | | Sul.cl. | D. | Water from clay/Oxford contact; sufficient for restaurant. |
| 18 | 1 | O.F. 1 | D. | 215 | 12 | 3M. | | C. | | H.cl. | D. | Sufficient. |
| 19 | 1 | O.F. 3 | Brd. | 211 | 79 | 20 | 79 | G. | | H.C. | D. | Yields 300 gallons per day; water from gravel beneath clay. |
| 20 | 1 | O.F. 2 | Brd. | 219 | 35 | 6 | 35 | C./Ox. | | H.C. | D.S. | Water from clay/Oxford contact. |
| 21 | 1 | O.F. 4 | Brd. | 217 | 113 | 20M. | 113 | C./Ot. | | H.C. | D. | Sufficient; water from clay/Ottawa contact. |
| 22 | 1 | O.F. 4 | D. | 217 | 13 | 5M. | | C. | | H.C. | D. | Low in late summer. |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22A | 1 O.F. | 4 | D. | 216 | 9 | 2M | | C. | | H.C. | S. | Sufficient; at barn |
| 23B | 1 O.F. | 4 | Drl. | 200 | 194 | +3 | 194(?) | C./R. | | H.Sal. | D.S. | Flowing-artesian well; water reported as coming from clay/ Rockcliffe contact. |
| 24 | 2 O.F. | 1 | Drl. | 231 | 87 | 15 | 37 | Ox. | | S.Sul. | D. | Sufficient. |
| 25 | 1 O.F. | 1 | Brd. | 208 | 20 | 10 | 20 | C. | | S.C. | D | Low in late summer. |
| 26 | 2 O.F. | 3 | D. | 211 | 9 | 3M | | C. | | H.I. | D. | Located at base of bluff. |
| 27 | 2 O.F. | 1 | D. | 221 | 12 | 4M. | | C. | | H.C. | D. | Sufficient. |
| 28 | 1 O.F. | 4 | D. | 219 | 12 | 4 | | C | | H.C. | D. | " |
| 29 | 1 O.F. | 1 | D. | 213 | 14 | 3M. | | C. | | H.Cl. | D. | Low in late summer |
| 30 | 1 O.F. | 2 | Brd. | 218 | | | | C. | | H.C. | D. | Sufficient for 2 families |
| 31 | 1 O.F. | 1 | D. | 211 | 10 | 6M. | | C. | | H.C. | D. | Low in late summer |
| 32 | 1 O.F. | 3 | D. | 208 | 12½ | 4 | | C. | | H.C. | D. | Sufficient. |
| 32A | 1 O.F. | 3 | Brd. | 201 | 42 | | 42 | C. | | H.C. | D. | " |
| 33 | 1 O.F. | 3 | D. | 217 | 14 | 4M. | | C. | | H.C. | D. | " |
| 34 | 2 O.F. | 3 | D. | 214 | 10 | 3M | | C. | | H.C. | D. | " |
| 35 | 2 O.F. | 2 | D. | 223 | | | | C. | | M.C. | D. | " |
| 35A | 2 O.F. | 2 | Brd. | 224 | 52 | 19M | 52 | C./Ox. | | | N. | |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 2 O.F. | 3 | D. | 212 | 13 | 2M. | | C. | | H.C. | D. | Low in late summer. |
| 37 | 2 O.F. | 3 | D. | 209 | 10 | 3. | | C. | | M.C. | G. | Located at base of bluff. |
| 37A | 2 O.F. | 3 | Brd. | 211 | | | | C. | | S.C. | D. | Sufficient. |
| 38 | 1 O.F. | 1 | D. | 219 | 16½ | 8 | | C. | | M.C. | D. | " |
| 39 | 1 O.F. | 3 | Drl. | 208 | 77 | 12M | 77 | G. | | S.C. | D. | Water from gravel beneath clay. |
| 40 | 1 O.F. | 3 | Brd. | 211 | 46 | 20M | 46 | G. | | H.C. | D. | " " " " " |
| 41 | 2 O.F. | 1 | Drl. | 215 | 38 | 4 | 38 | C./Ox. | | Sul.Cl. | D. | Water from clay/Oxford contact. |
| 42 | 2 O.F. | 2 | D. | 200 | 6 | 4M | | C. | | | N. | |
| 43 | 2O.F. | 1 | Drl. | 224 | 35½ | 3M. | 15 | Ox. | | M.C. | D. | Sufficient. |
| 44 | 1 O.F. | 3 | D. | 204 | 10 | 3M. | | C. | | H.Cl. | D. | Low in late summer. |
| 44A | 1 O.F. | 3 | Spt. | 203 | 6 | 0 | | C. | | G.Sul.Cl | N. | Dug out spring. |
| 45 | 2 O.F. | 2 | D. | 221 | 29 | 10M. | | C. | | H.C. | D. | " " " |
| 45A | 2 O.F. | 2 | D. | 222 | 13 | 6M. | | C. | | H.C. | D. | Sufficient |
| 46 | 1 O.F. | 1 | D. | 218 | 12 | 5M. | | C. | | H.C. | D. | " |
| 47 | 2 O.F. | 4 | D. | 218 | 12 | 4 | | C. | | H.C. | D. | Low in late summer. |
| 48 | 1 O.F. | 1 | Brd. | 213 | 17 | 12M. | 17 | C./Ox. | | H.C. | D. | Sufficient |
| 49 | 1 O.F. | 3 | D. | 202 | 11 | 3M. | | C. | | M.C. | D. | Sufficient for 3 families |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 1 | O.F. 3 | D. | 203 | 15½ | 5M. | | C.(?) | | H.C. | D. | Low in late summer. |
| 50A | 1 | O.F. 3 | Brd. | 200 | 34 | 2 | | S. | | S.Sul. | D. | Water from sand beneath clay. |
| 51 | 1 | O.F. 1 | Brd. | 216 | 28 | 8 | 28 | C./Ox. | | Sul.C. | D. | Water from clay/Oxford contact. |
| 52 | 1 | O.F. 3 | Brd. | 204 | 40 | | 40 | G. | | H.C. | D. | Water from gravel beneath clay. |
| 52A | 1 | O.F. 3 | Brd. | 208 | 23 | | | C. | | H.C. | S. | Low in late summer. |
| 53 | 1 | O.F. 3 | D. | 203 | 10 | 4M. | | S.(?) | | S.C. | D. | Sufficient. |
| 54 | 1 | O.F. 4 | Drl. | 181 | 75 | +1 | 75 | G. | 75.3 gph (July 1. 1952) | S.Sul | D. | Flowing well; Water from gravel beneath clay. |
| 55 | 1 | O.F. 3 | D. | 216 | 18 | 5M | | C. | | H.C. | | Low in late summer. |
| 56 | 1 | O.F. 2 | D. | 214 | | | | C. | | M.C. | D. | Sufficient |
| 57 | 2 | O.F. 2 | Drl. | 222 | 63 | | 55 | Ox. | | S.Sul. | D. | Sufficient for Hotel. |
| 57A | 2 | O.F. 2 | Brd. | 222 | 45 | | | C. | | H.C. | D. | Low in late summer. |
| 58 | 2 | O.F. 3 | D. | 216 | 12 | | | C. | | H.cl. | D. | Sufficient. |
| 59 | 1 | O.F. 3 | D. | 202 | 12 | 3M. | | C. | | H.C. | D. | Excellent well. |
| 60 | 1 | O.F. 3 | D. | 217 | 13 | 7M. | | C. | | | N. | |
| 61 | 1 | O.F. 4 | D. | 218 | 10 | 4M. | | C. | | S.C. | D. | Low in late Summer. |
| 62 | 1 | O.F. 1 | Brd. | 217 | 28 | 14M | | C. | | M.C. | D. | Sufficient. |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 63 | 1 O.F. | 1 | Brd. | 210 | 35 | 5 | 35 | C. | | S.C. | D. | Sufficient. |
| 64 | 2 O.F. | 3 | D. | 215 | | | | C. | | M.C. | D. | Located at base of slope. |
| 65 | 1 O.F. | 1 | D.(?) | 214 | | | | C. | | H.Cl. | D. | Sufficient. |
| 66 | 1 O.F. | 2 | Brd. | 213 | 32 | 10 | 32 | C./Ox. | | S.C. | D. | Water from clay/Oxford contact. |
| 67 | 1 O.F. | 3 | D. | 200 | | | | C. | | S.Cl. | D. | " |
| 68 | 1 O.F. | 1 | D. | 207 | 10 | 3M. | | C. | | H.C. | D. | " |
| 68A | 1 O.F. | 1 | D. | 201 | 5½ | 3 | | C. | | H.Sul. | S. | Goes dry. |
| 69 | 1 O.F. | 3 | D. | 209 | 12 | | | C. | | H.C. | D. | Sufficient. |
| 70 | 1 O.F. | 1 | D. | 208 | 25 | | 25 | C./Ox. | | H.C. | D. | Water " from clay/Oxford contact. |
| 71 | 1 O.F. | 4 | D. | 219 | 11 | 5M. | | C. | | M.C. | | Low during late summer. |
| 72 | 1 O.F. | 2 | Brd. | 221 | | | | C. | | H.C. | D. | Sufficient. |
| 73 | 2 O.F. | 2 | D. | 224 | 12 | | | C. | | H.C. | D. | " |
| 73A | 2 O.F. | 2 | Brd. | 223 | 58 | | 58 | C./Ox. | | | | Water from clay /Oxford contact. |
| 74 | 1 O.F. | 3 | Brd. | 207 | 7 | | | C. | | S.C. | D. | Low in late summer. |
| 75 | 2 O.F. | 2 | D. | 223 | 11½ | 8M | | C. | | H.C. | D. | Sufficient. |
| 76 | 1 O.F. | 1 | Brd. | 218 | 35 | | 35 | | | H.C. | D. | " |
| 76A | 1 O.F. | 1 | D. | 218 | 15 | | | C. | | H.C. | D. | " |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 77 | 1 O.F. | 2 | D. | 220 | 7 | 2M. | | C. | | S.C. | D. | Sufficient for 2 families. |
| 78 | 2 O.F. | 1 | D. | 215 | 13 | 3M. | | C. | | S.C. | D.S. | " " " " |
| 79 | 2 O.F. | 3 | D. | 216 | 5 | 2M. | | C. | | H.C. | D. | Located at base of bluff. |
| 80 | 1 O.F. | 2 | D. | 210 | 25 | 19 | 25 | C./Ox. | | H.C. | D. | Sufficient for 1 family. |
| 81 | 1 O.F. | 4 | D. | 218 | 10 | 4M | | C. | | H.Cl. | D. | Low during late summer. |
| 82 | 1 O.F. | 1 | Brd. | 206 | 13 | | 13 | C./Ox. | | M.C. | D. | Sufficient; water from clay/ Oxford contact. |
| 83 | 1 O.F. | 1 | D. | 218 | 10 | 3M. | | C. | | H.C. | D. | " |
| 84 | 1 O.F. | 3 | D. | 207 | 10 | 3M. | | C. | | H.C. | D. | " |
| 84A | 1 O.F. | 3 | Brd. | 206 | 17 | | | C./R. | | S.Sul. | D. | Water from clay/Rockcliffe contact. |
| 84B | 1 O.F. | 3 | Brd. | 211 | 70(?) | | | C./R. | | S.Sul. | D. | " " " " " |
| 85 | 1 O.F. | 2 | D. | 208 | $10\frac{1}{2}$ | 5M. | | C. | | Sul.C. | D | Low in late summer. |
| 86 | 2 O.F. | 1 | D. | 217 | 10 | 2M. | | C. | | H.C. | D. | Sufficient. |
| 87 | 1 O.F. | 2 | D. | 221 | $32\frac{1}{2}$ | 8M. | | C. | | H.C. | D. | " |
| 88 | 1 O.F. | 3 | Brd. | 212 | 50 | | 50 | C./R. | | H.C. | D. | Water from clay/Rockcliffe contact. |
| 88A | 1 O.F. | 3 | D. | 210 | $10\frac{1}{2}$ | 2 M. | | C. | | H.C. | N | |
| 89 | 1 O.F. | 1 | Brd. | 212 | 26 | 6M. | 26 | C./R. | | H.C. | D. | Water from clay/Rockcliffe contact. |
| 90 | 1 O.F. | 2 | D. | 222 | 14 | 3M. | | C. | | H.C. | D. | Sufficient. |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 91 | 2 O.F. | 2 | D. | 222 | | | | C. | | H.C. | D. | Sufficient. |
| 91A | 2 O.F. | 2 | Drl. | 215 | 55 | | 40 | Ox. | | Sul.Cl. | D. | " |
| 92 | 1 O.F. | 1 | D. | 219 | 15½ | 3M. | | C. | | M.C. | D. | Low in late summer, |
| 92A | 1 O.F. | 1 | Brd. | 219 | 35 | 4M. | | C. | | M.C. | D. | Sufficient. |
| 93 | 1 O.F. | 1 | D. | 216 | 12 | 3M. | | C. | | M.C. | D. | Low in late summer. |
| 94 | 1 O.F. | 3 | Brd. | 210 | 51 | 3M. | 51 | C./R. | | M.Sul. | D. | Water from clay/Rockcliffe contact. |
| 94A | 1 O.F. | 3 | D. | 209 | 13½ | 3M. | | C. | | M.C. | D. | Sufficient. |
| 95 | 2 O.F. | 1 | D. | 220 | 13 | 4M. | | C. | | S.C. | D. | Sufficient. |
| 96 | 1 O.F. | 2 | Brd. | 212 | 20 | 2 | | C. | | S.C. | D. | " |
| 97 | 1 O.F. | 2 | Brd. | 214 | 18+ | 3M. | | C. | | H.C. | D. | Sufficient for school. |
| 97A | 1 O.F. | 2 | D. | 212 | 15½ | 5M. | | C. | | Sal.C. | D. | " " " |
| 98 | 2 O.F. | 3 | D.(?) | 213 | | | | C. | | H.C. | D. | Sufficient |
| 99 | 2 O.F. | 3 | D. | 224 | 20+ | 10M. | | G. | | H.Cl. | D. | Water from gravel beneath clay. |
| 100 | 2 O.F. | 4 | D. | 218 | 12 | 3M. | | C. | | H.C. | D. | Sufficient. |
| 101 | 1 O.F. | 3 | Brd. | 191 | 52 | | 52 | G. | 77.2 g.p.h. (July 1,1952) | S.Sul. | D. | Flowing-Artesian well; water from gravel beneath clay. |
| 102 | 1 O.F. | 3 | Brd. | 192 | 69 | 0 | 69 | S. | 40.2 g.p.h. (July 1,1952) | S.C. | D. | Flowing-Artesian well; water from sand beneath clay. |

Village of Orleans

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 103 | 1 O.F. | 3 | Brd. | 213 | 37 | 8M | | C. | | M.Cl. | D. | Sufficient. |
| 104 | 1 O.F. | 3 | Brd. | | 42 | | | S. | | Sul. | D. | Flowing-Artesian well; water from sand beneath clay. |

## Compilation of Well Data

The following abbreviations were used in the accompanying compilation sheets of well data.

Concession: O.F. - Ottawa Front
R.F. - Rideau Front

Type: Brd. - bored; D. - dug; D.D.H. - diamond drill hole; Drl. - drilled; Spr. - spring; Spt. - Sand point.

Depth to Water Surface: M. - measured.

Aquifer: Al. - alluvium; C.- clay; C.T. - clay till; G. - gravel; G.T. - gravelly till; S. - sand; S.T. - sandy till; S.-C.T. - stoney, clay till.

(N.B.) Symbols such as S./C. indicate that the ground water occurs at or near the contact of the two materials.

Ca. - Carlsbad formation; Bi. - Billings formation; O t. - Ottawa formation; R. - Rockcliffe formation; Ox. - Oxford formation; M. - March formation; N. - Nepean formation; B.R. - bedrock.

Quality: C. - clear; Cl. - cloudy; H. - hard; I. - ironey; M. - medium hard; Min. - mineral taste; S. - soft; Sal. - salty; Sul. - sulphur; ☆ Sample taken for chemical analyses.

Use: B. baths for medicinal purposes; D. - domestic; G. - gardening; I. - irrigation; M. - municipal; N. - not used; S. - stock.

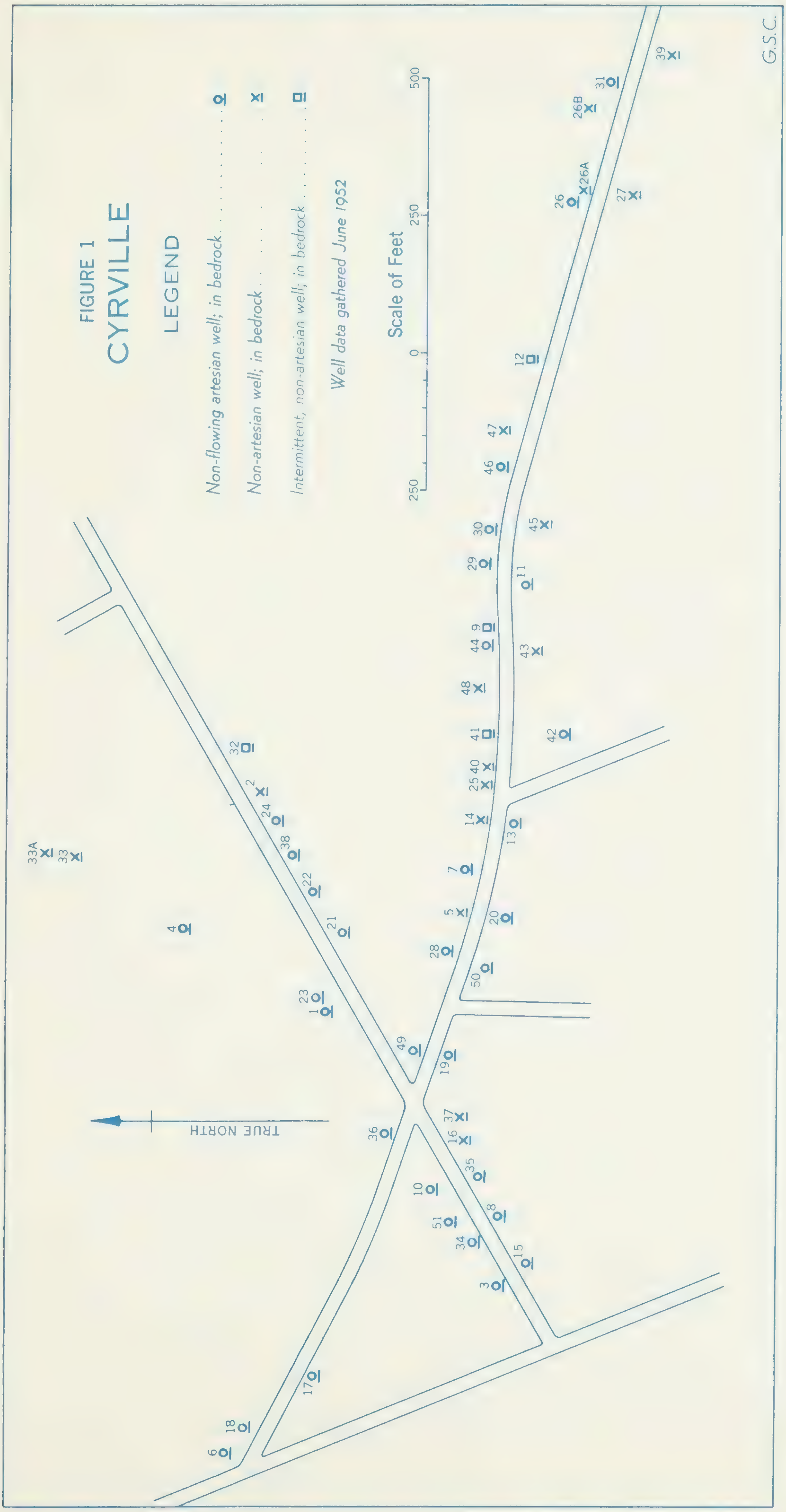


FIGURE 1
CYRVILLE
LEGEND
Non-flowing artesian well; in bedrock
Non-artesian well; in bedrock
Intermittent, non-artesian well; in bedrock
Well data gathered June 1952
Scale of Feet
250
0
250
500
TRUE NORTH
G.S.C.

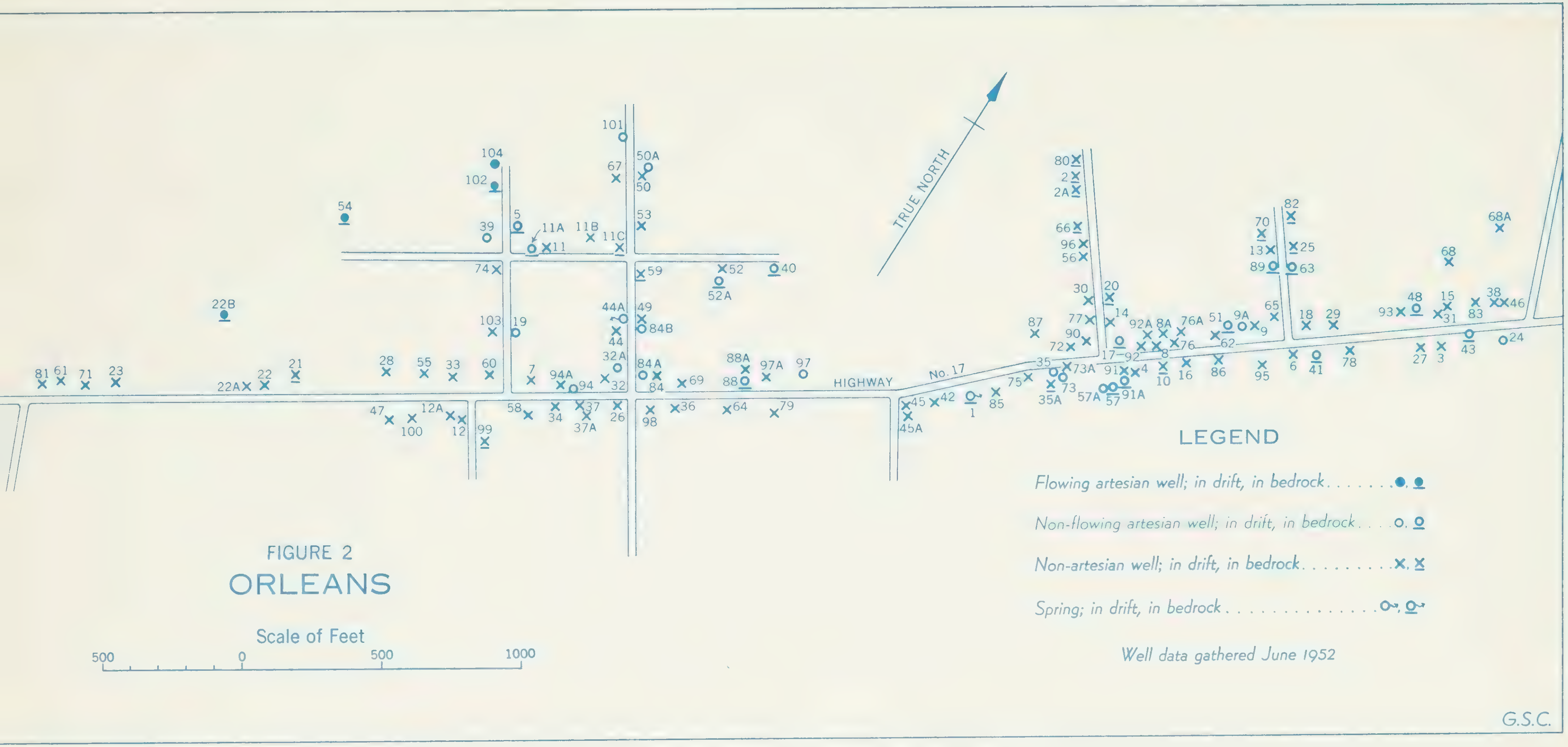



FIGURE 2
ORLEANS

Sand
"

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev. (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 1 | 1 | NW. | 1 | Drl. | Steel 6 | 105 | 20 | -9 | 105 | Sand | pre-Vashon | Salty | Dom. | D.G.J. | --- | Log inferred. Possible sea water contamination. |
| 1 | 8 | NW. | 1 | " | " 4 | 200 | 285 | -100 | 70 | " | Colebrook | --- | " | C.D.G.I.N. | --- | Pumps sand. Water unconfined. |
| 1 | 8 | NW. | 2 | " | " 4 | 128 | 225 | -80 | 126 | " | " | --- | " | C.D.G.I.N.Q. | --- | Confined under 6' clay. |
| 1 | 10 | SW. | 1 | " | Iron 6 | 175 | 10 | +8 | 53,160 | Sand, gravel | pre-Vashon | Clear, good | Pub. | C.I.J.N. | 7500 | White Rock Water Works. |
| 1 | 10 | SW. | 2 | " | " 8 | 210 | 13 | +2 | 60;127;161 | " " | " " | " " | Pub. | C.I.J.N. | 7500 | " " " " |
| 1 | 10 | SW. | 3 | " | " 8 | 208 | 15 | +1 | 51;112;160 | " " | " " | " " | Pub. | C.I.J.N. | 7500 | " " " " |
| 1 | 10 | NE. | 4 | " | " 2 | 80 | 130 | -2 | 80 | Gravel | " " | Clear, soft | Dom. | C.G.I.J.N. | --- | Confined water. |
| 1 | 12 | NE. | 1 | " | " 4 | 54 | 119 | +3 | 54 | " | Colebrook | " " | " | C.I.N. | 1200 | |
| 1 | 12 | NE. | 2 | Dug | Conc. 84 | 25 | 100 | 0 | 25 | " | " | " " | " | I.N. | --- | |
| 1 | 12 | SE. | 3 | Drl. | Iron 3 | 110 | 70 | +3 | 110 | Sand | --- | " " | " | D.G. ? | 240 | Shells at El.20 |
| 1 | 12 | SE. | 4 | " | " 2 | 55 | 69 | +4 | 46 | Pea-gravel | --- | " " | " | D.G. ? | 230 | " " El.14 |
| 1 | 12 | SE. | 5 | " | " 6 | 118 | 153 | -58 | 80 | Sand, gravel | Colebrook | " " | " | C.D.G.I.N. | 350 | |
| 1 | 13 | SE. | 1 | " | " 5 | 133 | 230 | -100 | 130 | " " | pre-Vashon | " " | " | G.I.J.N. | 280 | Water below 100' of clays. |
| 1 | 13 | SW. | 2 | Dug | --- 72 | 43 | 210 | -40 | 16 | Silty stony-clay | Newton | Soft | " | G. | --- | Surface water table. Seasonal fluctuations. |
| 1 | 16 | SW. | 1 | " | --- 48 | 11 | 315 | -5 | 9 | Pebbly silty clay | " | " | " | D.G. | --- | Water table perched under large flat area. |
| 1 | 17 | SW. | 1 | Drl. | " 4 | 80 | 250 | -75 | 75 | Sand, gravel | Colebrook | Fairly hard | Dom. Irr. | C.D.G.I.N. | 650 | |
| 1 | 17 | SW. | 2 | " | " 4 | 106 | 276 | -76 | 104 | Sand | Quadra | " | Dom. | C.G.I.K.L.Q. | 350+ | |
| 1 | 17 | SW. | 3 | " | " 4 | 167 | 230 | -30 | 146 | Gravel | Seymour | Clear, good | Irr. | C.G.I.K.L.Q.U. | --- | |
| 1 | 17 | SW. | 4 | " | " 4 | 132 | 292 | -92 | 131 | Fine sand | pre-Vashon | --- | Dom. | C.D.G.I,J.,N. | --- | Abandoned. |
| 1 | 17 | SW. | 5 | " | --- 4 | 107 | 280 | --- | --- | --- | --- | --- | --- | C.D.G.I.N. | --- | Dry hole. Not deep enough. |
| 1 | 18 | NW. | 1 | " | Iron 4 | 140 | 110 | -30 | --- | --- | --- | Clear, good | Dom. | --- | --- | Log unknown. |
| 1 | 18 | NW. | 2 | Dug | Conc. 36 | 20 | 10 | -10 | 20 | --- | --- | " " | " | --- | --- | " " |
| 1 | 19 | SE. | 1 | Drl. | Iron 4 | 45 | 190 | -15 | --- | --- | --- | " " | " | --- | --- | " " |
| 1 | 19 | SW. | 2 | " | " 4 | 140 | 150 | -120 | --- | --- | --- | " " | " | --- | --- | " " |
| 1 | 20 | NW. | 1 | " | " 6 | 30 | 0 | +1 | 25 | Sand, gravel | Colebrook | " " | " | A.C.F.I.N. | 2000 | Pumped. Supplies 8 houses. |
| 1 | 21 | NE. | 1 | " | " 4 | 200 | 270 | --- | --- | --- | --- | --- | --- | C,F,G,I,N | --- | Dry hole. |
| 1 | 22 | NW. | 1 | Dug | --- 48 | 9 | 125 | -6 | 8 | Sand | Colebrook | Clear, good | Dom. | G.I.N.Q. | --- | No seasonal fluctuation. |
| 1 | 23 | NE. | 1 | " | Wood 60 | 15 | 65 | -12 | 0 | " | Quadra | " " | " | D.Q. | --- | " " " |
| 1 | 23 | NE. | 2 | " | " 60 | 8 | 150 | 0 | 8 | Gravel | Colebrook | " " | " | C.I.N. | --- | Slight seasonal fluctuation. |
| 1 | 23 | NW. | 3 | Drl. | Iron 3 | 120 | 138 | -60 | 120 | " | Quadra | " " | " | G.N.Q. | --- | |
| 1 | 24 | NE. | 1 | Spr. | --- --- | 0 | 48 | 0 | 0 | Sand | Quadra | " " | Pub. | Q. | 7500 | Kensington Water Works. At foot of Surrey till slope |
| 1 | 24 | NW. | 2 | Dug | --- 60 | 11.5 | 160 | -5 | 11 | Gravel | Colebrook | " " | Dom. | C.I.N. | --- | |
| 1 | 24 | NW. | 3 | Drl. | Iron 4 | 60 | 50 | -2 | 60 | Sand | Quadra | " " | " | D.G.Q. | --- | Shells at El.-10 |
| 1 | 25 | NE. | 1 | " | " 2 | 164 | 10 | +12 | 160 | " | Cloverdale | Some salt | " | A.B. | 30 | Log sketchy. |
| 1 | 25 | SE. | 2 | " | " 2 | 215 | 15 | +14 | 215 | " | " | Hard | " | A.B. | 30 | " " |
| 1 | 25 | SE. | 3 | " | " 2 | 290 | 17 | +16 | 290 | " | " | " | " | A.B. | 30 | " " |
| 1 | 26 | NW. | 1 | Drl. | " 4 | 300+ | 10 | +10 | --- | --- | --- | --- | " | --- | 20 | Log unknown. |
| 1 | 34 | NW. | 1 | " | " 2½ | 238 | -2 | +2 | 250 | Sand | Cloverdale | Trace salt | " | A,B. | 20 | Log sketchy. |
| 1 | 34 | NW. | 2 | " | " 3 | 228 | 10 | +10 | 220 | " | " | Clear, good | " | A,B. | 3000 | Log sketchy. Shells at El.-205. |

REPRESENTATIVE WELL RECORDS OF SURREY MUNICIPALITY, NEW WESTMINSTER MAP-AREA, BRITISH COLUMBIA

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev. (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 2 | 1 | NW. | 1 | Drl. | Iron 2 | 256 | 5 | +10 | 241 | Sand, gravel | Cloverdale | Hard | Dom. | A,B. | 170 | Shells reported in similar wells at El.-70,-120,-220 |
| 2 | 2 | SW. | 1 | " | " 4 | 220 | 10 | +13 | 217 | Sand | " | Fairly hard | Dom. Stk. | A,B. | 100 | Log sketchy. |
| 2 | 3 | SE. | 1 | " | " 2 | 245 | 12 | +14 | 245 | " | " | Trace salt | Dom. | A,B. | 200 | " " |
| 2 | 3 | NW. | 2 | Dug | --- 48 | 42 | 223 | | 26 | " | Quadra | --- | " | G,N,Q. | --- | Intermittent Well. |
| 2 | 4 | NE. | 1 | Spr. | --- 48 | 4 | 25 | 0 | 3 | " | " | Soft | " | C,Q. | --- | |
| 2 | 6 | NE. | 1 | Dug | Conc.48 | 45.5 | 167 | -43 | --- | Sand, gravel | Colebrook | Fairly hard | " | C,G,I.N. | --- | Log not complete. |
| 2 | 6 | SW. | 2 | " | " 36 | 19 | 38 | -16 | 0 | " " | " | Fairly hard | " | N. | --- | |
| 2 | 6 | SW. | 3 | Spr. | --- 36 | 2 | 95 | 0 | 0 | " " | " | Fairly hard | " | N. | --- | |
| 2 | 9 | NE. | 1 | Dug | Conc.60 | 23 | 159 | -6 | 23 | Gravel | " | Soft | " | G,N. | --- | Slight seasonal fluctuation. |
| 2 | 10 | NE. | 1 | " | " 36 | 9 | 78 | -6 | 0 | Sand, gravel | " | " | " | N. | 50 | No shortage in 30 yrs. |
| 2 | 10 | NE. | 2 | " | " 48 | 12 | 167 | -8 | 12 | " " | " | " | " | N. | --- | No seasonal fluctuations. |
| 2 | 10 | NW. | 3 | " | --- 48 | 17 | 160 | -11 | 9 | " " | " | " | " | G,I,N. | --- | |
| 2 | 10 | NE. | 4 | " | --- 48 | 10 | 165 | -7 | 9 | " " | " | " | " | G,I,N. | --- | |
| 2 | 11 | SE. | 1 | " | --- 48 | 32 | 48 | -18 | 30 | Sand | Quadra | " | " | C,G,N.Q. | --- | |
| 2 | 11 | SW. | 2 | " | Conc.48 | 22 | 36 | -15 | 0 | Sandy clay | Newton | " | " | G. | 50 | |
| 2 | 11 | SW. | 3 | Spr. | --- --- | 0 | 55 | 0 | 0 | Sand | Quadra | " | " | Q. | 50 | |
| 2 | 11 | NW. | 4 | Dug | Conc.40 | 15 | 70 | -10 | 10 | " | " | " | " | C,G,Q. | --- | |
| 2 | 12 | NE. | 1 | Drl. | Iron 2 | 30 | 82 | -30 | 30 | " | " | " | " | --- | --- | |
| 2 | 12 | SE. | 2 | Dug | --- 72 | 23 | 75 | -11 | 23 | Gravel | Colebrook | " | " | G,N. | --- | Seasonal fluctuations. |
| 2 | 12 | SE. | 3 | Drl. | Iron 5 | 647 | 95 | -16 | 605 | Sand | --- | " | Pub. | --- | --- | Surrey Centre School. |
| 2 | 12 | [illegible] | 4 | Dug | --- 72 | 6 | 50 | 0 | 5 | Gravel | Colebrook | " | Dom. | G,I,N. | --- | |
| 2 | 12 | SE. | 5 | " | --- 48 | 7 | 8 | -3 | 6 | " | " | " | " | G,I,N. | --- | |
| 2 | 12 | SW. | 6 | Drl. | Iron 2 | 170 | 5 | +10 | --- | --- | --- | Fairly hard | " | --- | --- | |
| 2 | 12 | NW. | 7 | Dug | Wood 96 | 8 | 15 | -8 | 0 | Sand, gravel | Colebrook | Soft | " | N. | 500 | |
| 2 | 12 | NE. | 8 | " | " 48 | 23 | 127 | -20 | 15 | " " | " | " | " | G.N. | --- | |
| 2 | 12 | [illegible] | 9 | Drl. | Iron 3 | 160 | 10 | +12 | 160 | Gravel | " | " | Dom., Stk. | A,D,F,I,N. | 240 | Shells at El.-80' |
| 2 | 12 | [illegible] | 10 | " | " 4 | 32 | 10 | +9 | 32 | " | " | Hard | Dom., Stk. | I,N. | 1800 | Shells at El.0' |
| 2 | 14 | SE. | 1 | " | " 3 | 120 | 10 | +4 | 120 | " | " | Soft | Dom., Stk. | I,N. | 90 | Shells at El.-50' |
| 2 | 14 | SW. | 2 | Dug | Conc.48 | 29 | 30 | -14 | 29 | " | " | " | Dom., Stk. | G,I,N. | 300 | |
| 2 | 14 | SW. | 3 | " | " 48 | 21 | 28 | -10 | 21 | " | " | " | Dom. | G,I,N. | --- | |
| 2 | 15 | [illegible] | 1 | Spr. | Wood 48 | 1 | 40 | 0 | 0 | --- | --- | " | | --- | --- | Bog Area. |
| 2 | 15 | SE. | 2 | Dug | " 60 | 16 | 48 | -11 | 11 | Gravel | Colebrook | " | | G,I,N. | --- | |
| 2 | 15 | SW. | 3 | Drl. | Iron 1 | 60 | 50 | +5 | 50 | Sand | --- | " | Dom., Stk. | G,I. | 100 | |
| 2 | 15 | [illegible] | 4 | Dug | Wood 48 | 20 | 225 | -16 | 20 | " | Quadra | " | Dom., Stk. | I,N,Q. | 500 | Cannot pump dry. |
| 2 | [illegible] | [illegible] | 1 | Drl. | Iron 5 | 38 | 188 | -12 | 20 | Gravel | Colebrook | " | Dom. | G,I,N. | 2000+ | Water unconfined. |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev. (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 2 | 17 | NW. | 2 | Dug | --- 36 | 15 | 290 | -10 | 15 | Gravel | Colebrook | Soft | Dom. | G,I. | --- | |
| 2 | 20 | SE. | 3 | " | Conc. 72 | 82 | 258 | -80 | 65 | Sand | Quadra | " | Dom., Stk. | C.G.I,K,L,Q. | --- | Peat and shells from El. 173-196. |
| 2 | 21 | NE. | 1 | Bor. | Iron 18 | 25 | 85 | +7 | 23 | Gravel | Colebrook | " | Dom. | G,I,N. | 100 | Natural flow. |
| 2 | 21 | NE. | 2 | Spr. | Wood 48 | 4 | 125 | 0 | 0 | --- | --- | " | " | --- | --- | |
| 2 | 22 | NE. | 1 | " | --- 36 | 2 | 10 | 0 | 0 | --- | --- | " | " | --- | --- | |
| 2 | 22 | SE. | 2 | Dug | --- 48 | 18 | 35 | -13 | 0 | Clay,silt | Newton | " | " | G. | --- | |
| 2 | 22 | SW. | 3 | " | --- 48 | 32 | 192 | -30 | 30 | Sand,gravel | Colebrook | " | " | C,G,I,N. | --- | Slight Seasonal fluctuations. |
| 2 | 22 | NW. | 4 | " | --- 36 | 18 | 162 | -12 | 18 | Sand | " | " | " | C,G,I,N. | --- | Slight seasonal fluctuations. |
| 2 | 22 | NW. | 5 | " | --- 36 | 20 | 113 | +9 | 20 | Sand,gravel | " | " | " | C,G,I,N. | --- | Slight seasonal fluctuations. |
| 2 | 23 | NW. | 1 | " | Wood 36 | 7 | 43 | -3 | --- | --- | --- | " | " | --- | 50 | |
| 2 | 24 | NE. | 1 | " | " 36 | 8 | 32 | 0 | 8 | Sand,gravel | Colebrook | " | " | I,N. | 100 | |
| 2 | 24 | NE. | 2 | Spr. | " 24 | 4 | 31 | 0 | 0 | " " | " | " | " | N. | --- | |
| 2 | 24 | NW. | 3 | Dug | " 48 | 20 | 176 | -15 | 20 | " " | " | Hard | " | I,N. | 3000 | |
| 2 | 25 | NE. | 1 | Drl. | Iron 4 | 94 | 64 | -15 | 90 | Sand | Quadra | Soft | " | G,I,Q. | --- | Water fluctuates from El. 56 to 49. Shells at El.-26. |
| 2 | 25 | SE. | 2 | Dug | --- 48 | 15 | 140 | 0 | 14 | " | " | Hard | " | G,Q. | --- | Constant yearly. |
| 2 | 25 | NE. | 3 | " | --- 36 | 35 | 216 | -33 | 35 | " | --- | Soft | Dom., Stk. | --- | --- | |
| 2 | 25 | SE. | 4 | " | --- 36 | 10 | 144 | -6 | 10 | " | Quadra? | " | Dom. | G,I,N,Q. | --- | |
| 2 | 25 | SW. | 5 | " | Wood 48 | 14 | 166 | -11 | 14 | " | " | " | " | G,Q. | --- | |
| 2 | 25 | SW. | 6 | " | --- 48 | 16 | 205 | -4 | 16 | Gravel | Colebrook | " | " | G,N. | --- | |
| 2 | 25 | SW. | 7 | " | --- 48 | 16 | 205 | 0 | 16 | " | " | " | " | G,N. | --- | |
| 2 | 25 | SW. | 8 | " | --- 72 | 21 | 220 | -17 | 21 | " | " | " | " | G,I.N, | --- | |
| 2 | 25 | NW. | 9 | Drl. | Iron 5 | 46 | 230 | -19 | 30 | " | " | " | " | G,I,N. | 700 | |
| 2 | 25 | NW. | 10 | " | " 6 | 40 | 210 | -15 | --- | --- | --- | " | Dom., Stk. | --- | --- | |
| 2 | 25 | NW. | 11 | Dug | Conc. 36 | 40 | 255 | -25 | --- | Sand,gravel | Colebrook | " | Dom. | G,I,N. | --- | Generalized log. |
| 2 | 25 | NW. | 12 | " | " 36 | 16 | 190 | -14 | --- | --- | --- | " | " | --- | --- | |
| 2 | 26 | SE. | 1 | " | Wood 48 | 14 | 210 | -10 | 12 | Sand,gravel | Colebrook | " | " | G,I,N. | --- | |
| 2 | 26 | SE. | 2 | " | Conc. 42 | 18 | 211 | -9 | 6 | " " | " | " | " | G,I,N. | --- | |
| 2 | 26 | SE. | 3 | " | " 36 | 9 | 209 | --- | 8 | " " | " | " | " | G,N. | --- | Well incomplete. |
| 2 | 26 | SE. | 4 | " | " 36 | 10 | 214 | -7 | 10 | " " | " | " | " | G,I,N. | --- | |
| 2 | 26 | SE. | 5 | " | --- 48 | 20 | 212 | -14 | 20 | " " | " | " | " | G,I,N. | --- | |
| 2 | 26 | SW. | 6 | " | Conc. 41 | 28 | 240 | -24 | 20 | " " | " | " | " | G,I,N. | --- | |
| 2 | 26 | SE. | 7 | " | " 72 | 28 | 251 | -24 | 25 | " " | " | " | Dom., Stk. | G,I,N. | 50 | |
| 2 | 26 | SE. | 8 | " | --- 48 | 38 | 254 | -36 | 16 | " " | " | " | Dom. | G,I,N. | --- | |
| 2 | 26 | SW. | 9 | Spr. | 5X15 | 0 | 205 | 0 | 0 | --- | --- | " | " | --- | --- | |
| 2 | 26 | SW. | 10 | Dug | --- 48 | 11 | 190 | -9 | 11 | Sand,gravel | Colebrook | " | " | G,I,N. | --- | |
| 2 | 26 | SW. | 11 | " | --- 48 | 12 | 228 | -10 | 12 | Sand | " | " | " | G,I,N. | --- | Supplies three houses. |
| 2 | 26 | SW. | 12 | " | --- 60 | 10 | 242 | -8 | 10 | " | " | " | Dom., Stk. | G,I,N. | 50 | |
| 2 | 26 | NW. | 13 | " | --- 36 | 38 | 261 | -36 | --- | Sand,gravel | " | " | Dom., Stk. | G,I,N. | 50 | Log incomplete. |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev. (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 2 | 26 | NE. | 14 | Drl. | Iron 6 | 75 | 271 | -61 | 50,75 | Sand,gravel | Quadra | Soft | Dom., Stk. | B,G,I,K,L,Q. | --- | |
| 2 | 26 | NW. | 15 | Dug | Conc.48 | 25 | 265 | -14 | 12 | " " | Colebrook | " | Dom. | G,I,N. | --- | |
| 2 | 26 | NE. | 16 | " | " 48 | 52 | 295 | -49 | 10 | " " | " | " | " | C,G,I,N. | --- | |
| 2 | 26 | NW. | 17 | " | " 42 | 37 | 309 | -35 | 18 | " " | " | " | " | C,G,I,N. | 50 | |
| 2 | 26 | NE. | 18 | " | Wood 36 | 80 | 309 | -77 | 22 | " " | " | " | " | C,G,I,N. | --- | |
| 2 | 27 | NE. | 1 | " | --- 48 | 13 | 197 | -10 | --- | --- | --- | " | Dom., Stk. | --- | --- | |
| 2 | 27 | NE. | 2 | " | --- 48 | 24 | 168 | -19 | --- | Sand,gravel | Colebrook | " | Dom., Stk. | G,I,N. | --- | Log incomplete. |
| 2 | 27 | NE. | 3 | " | --- 48 | 13 | 133 | -6 | --- | --- | --- | " | Dom., Stk. | --- | --- | |
| 2 | 27 | NE. | 4 | " | --- 48 | 20 | 212 | -15 | --- | --- | --- | " | Dom. | --- | --- | |
| 2 | 27 | SE. | 5 | " | --- 48 | 16 | 130 | -10 | --- | --- | --- | " | Dom., Stk. | --- | --- | |
| 2 | 27 | SE. | 6 | " | --- 48 | 18 | 67 | -15 | --- | Sand,gravel | --- | Hard | Dom., Stk. | --- | --- | |
| 2 | 27 | SE. | 7 | " | --- 60 | 24 | 93 | -18 | 24 | " " | Colebrook | Soft | Dom., Stk. | G,I,N. | --- | Supplies three homes. |
| 2 | 27 | SW. | 8 | " | --- 48 | 23 | 90 | -20 | --- | " " | " | " | Dom., Stk. | G,I,N. | --- | Log incomplete. |
| 2 | 27 | SW. | 9 | " | --- 48 | 15 | 93 | -10 | --- | " " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 27 | SW. | 10 | " | --- 36 | 18 | 110 | -14 | 15 | " " | " | " | Dom. | G,I,N. | --- | |
| 2 | 27 | SW. | 11 | Drl. | Iron 3 | 50 | 142 | -21 | 50 | " " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 27 | SW. | 12 | Dug | --- 36 | 17 | 140 | -7 | 9 | " " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 27 | SW. | 13 | " | Wood 60 | 12 | 157 | -7 | --- | " " | " | " | Dom., Stk. | G,I,N. | --- | Log incomplete. |
| 2 | 27 | NW. | 14 | " | --- 36 | 3 | 173 | -1 | 0 | " " | " | " | Dom., Stk. | N. | --- | Spring. |
| 2 | 27 | NE. | 15 | " | --- 36 | 9 | 208 | -3 | --- | " " | " | " | Dom., Stk. | G,I,N. | --- | Log incomplete. |
| 2 | 28 | NE. | 1 | " | Wood 60 | 10 | 164 | -8 | 9 | Sand | Quadra | " | Dom., Stk. | G,I,N,Q. | --- | |
| 2 | 28 | SE. | 2 | " | " 48 | 16 | 143 | -2 | 14 | Sand,gravel | Colebrook | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 28 | SE. | 3 | " | " 48 | 23 | 103 | -4 | 23 | " " | " | " | Dom., Stk. | D,G,K,L. | --- | |
| 2 | 32 | NE. | 1 | Drl. | Iron 4 | 70 | 217 | --- | --- | Gravel | " | --- | --- | G,I,N. | Dry | |
| 2 | 33 | SE. | 1 | Dug | Wood 48 | 33 | 252 | -18 | 30 | " | " | Soft | Dom., Stk. | G,I,N. | --- | |
| 2 | 33 | SE. | 2 | " | --- 48 | 33 | 245 | -27 | 33 | " | " | " | Dom. | G,I,N. | --- | |
| 2 | 33 | SE. | 3 | " | --- 48 | 20 | 230 | -12 | 11 | " | " | " | " | G,N. | --- | |
| 2 | 33 | SE. | 4 | " | Conc.60 | 14 | 205 | -4 | 13 | " | " | " | " | G,I,N. | --- | |
| 2 | 34 | SE. | 1 | " | " 48 | 35 | 314 | -31 | 32 | " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 34 | SE. | 2 | " | --- 48 | 16 | 251 | -3 | 12 | " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 34 | SW. | 3 | " | --- 48 | 8 | 215 | -4 | 8 | " | " | " | Dom. | G,I,N. | --- | |
| 2 | 34 | SW. | 4 | " | --- 48 | 15 | 212 | -10 | 6 | " | " | " | " | G,I,N. | --- | |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev. (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 2 | 34 | SW. | 5 | Dug | Conc. 48 | 85 | 295 | -82 | 85 | Sand | Quadra | Soft | Dom., Stk. | G.I.K.L,N,Q. | --- | |
| 2 | 35 | NE. | 1 | " | " 60 | 30 | 222 | -25 | 30 | Sand, gravel | Colebrook | " | Dom. | G,I,N. | --- | Supplies three houses. |
| 2 | 35 | NE. | 2 | " | --- 48 | 16 | 224 | -10 | 16 | " " | " | " | Dom., Stk. | C,G,N. | --- | |
| 2 | 35 | SE. | 3 | Drl. | Iron 4 | 50 | 248 | -29 | 40 | " " | " | " | Dom. | C,G,I.N | --- | |
| 2 | 35 | SE. | 4 | Dug | --- 48 | 69 | 290 | -64 | 20 | " " | " | " | Dom., Stk. | C,G,I,N. | --- | |
| 2 | 35 | SE. | 5 | " | Conc. 48 | 20 | 228 | -12 | 20 | " " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 35 | SE. | 6 | " | " 48 | 70 | 298 | -60 | 20 | " " | " | " | Dom. | C,G,I,N. | --- | Supplies three houses. |
| 2 | 35 | SE. | 7 | " | " 42 | 66 | 302 | -60 | 25 | " " | " | " | Dom., Stk. | C,G,I,N. | --- | |
| 2 | 35 | SE. | 8 | " | Wood 42 | 67 | 298 | -64 | 67 | " " | --- | " | Dom. | C,G,I,J. | --- | |
| 2 | 35 | SW. | 9 | " | Conc. 36 | 28 | 322 | -23 | 23 | " " | Colebrook | " | " | C,G,I.N. | --- | |
| 2 | 35 | SW. | 10 | " | " 72 | 38 | 323 | -30 | 28 | " " | Semiamu | " | Dom., Stk. | C,G,I,K,L. | --- | Sediments. Seasonal fluctuations. |
| 2 | 35 | SW. | 11 | " | " 36 | 63 | 288 | -60 | --- | " " | --- | " | Pub. | --- | --- | Also supplies 3 houses in summer. |
| 2 | 35 | NE. | 12 | " | --- 48 | 15 | 240 | -10 | --- | " " | --- | " | Dom. | --- | --- | Log incomplete. |
| 2 | 36 | NE. | 1 | Drl. | Iron 2 | 360 | 40 | +8 | 360 | Sand | Quadra | " | Dom., Stk. | D,F,G,K,L,Q. | 100 | Natural flow. |
| 2 | 36 | SE. | 2 | " | " 3 | 235 | 34 | +10 | 70 | " | " | " | Dom., Stk. | D,F,G,K,L,Q. | 360 | " " |
| 2 | 36 | SE. | 3 | Dug | Wood 36 | 21 | 46 | 0 | 19 | Sand, gravel | Colebrook | " | Dom., Stk. | D,F,N. | --- | |
| 2 | 36 | SE. | 4 | " | --- 60 | 16 | 67 | -12 | 15 | " " | " | " | Dom., Stk. | G,I,N. | --- | |
| 2 | 36 | SE. | 5 | Spr. | Wood 12 | 1 | 115 | 0 | 0 | " " | " | " | Dom., Stk. | N. | --- | |
| 2 | 36 | SW. | 6 | Dug | " 36 | 8 | 132 | -6 | --- | " " | " | " | Dom., Stk. | --- | --- | Log incomplete. |
| 2 | 36 | SW. | 7 | " | " 72 | 32 | 215 | -28 | 32 | Sand | --- | " | Dom. | --- | --- | " " |
| 2 | 36 | SW. | 8 | " | " 72 | 35 | 184 | -6 | 35 | --- | --- | " | Dom., Stk. | --- | --- | " " |
| 2 | 36 | NW. | 9 | " | " 48 | 22 | 176 | -17 | 19 | Sand, gravel | Colebrook | " | Dom. | G,I,N. | --- | |
| 2 | 36 | NW. | 10 | " | --- 36 | 6 | 152 | -1 | --- | Sand | --- | " | " | --- | --- | |
| 7 | 4 | NW. | 1 | Drl. | Iron 2 | 319 | 45 | +15 | --- | Gravel | --- | " | Dom., Stk. | --- | 250 | Natural flow. Log incomplete. |
| 7 | 4 | NE. | 2 | Drn. | " 2 | 61 | 95 | +10 | 60 | " | Seymour | " | Dom. | D.F.G.K.Q.U. | --- | |
| 7 | 6 | NW. | 1 | Drl. | " 2 | 270 | 50 | +5 | 265 | " | Seymour | " | " | D.F.G.K.Q.U. | 500 | Natural flow. |
| 7 | 7 | SW. | 1 | " | " 2 | 200 | 60 | +18 | 200 | Sand | Quadra | " | Dom., Stk. | D.F.G.K.L.Q. | 500 | " " |
| 7 | 7 | NW. | 2 | " | " 10 | 303 | 60 | +8 | 275 | " | Seymour | " | Pub. | D.F.G.K.L.M.O.P.U. | 600 | Surrey Municipality. Natural flow. |
| 7 | 7 | NW. | 3 | Dug | Wood 36 | 15 | 100 | 0 | 15 | Gravel | Colebrook | " | Dom. | H.G.I.N. | --- | |
| 7 | 7 | NE. | 4 | Drl. | Iron 4 | 51 | 96 | -8 | 32 | Sand | Quadra | " | " | G.I.Q. | --- | |
| 7 | 8 | NE. | 1 | " | " 2 | 250 | 51 | +15 | 185 | " | " | " | " | D.F.G.K.L.Q. | 300 | Natural flow. Community Hall. |
| 7 | 8 | N.. | 2 | " | " 2 | 115 | 78 | +3 | 60 | " | " | " | Dom., Stk. | D.F.G.K.L.Q. | 200 | Natural flow. |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 7 | 9 | SE. | 1 | Drn. | Iron 2 | 75 | 100 | +3 | --- | --- | --- | Soft | Dom. | --- | 15 | Log incomplete. |
| 7 | 9 | SE. | 2 | Drl. | " 2 | 95 | 160 | +5 | 60 | Sand | Quadra | " | " | D.G.Q. | --- | Peat reported in aquifer. |
| 7 | 9 | NW. | 3 | " | " 2 | 310 | 57 | +15 | 250 | " | " | " | " | D.F.Q. | --- | |
| 7 | 10 | NW. | 1 | Drn. | --- 36 | 30 | 141 | -11 | 0 | Sand,gravel | Campbell | " | Dom., Stk. | H. | --- | |
| 7 | 15 | NE. | 1 | " | Iron 2 | 22 | 165 | -18 | 0 | " " | " | " | Dom., Stk. | H. | --- | |
| 7 | 15 | SE. | 2 | Dug | --- 48 | 22 | 185 | -14 | 0 | " " | " | " | Dom., Stk. | H. | --- | |
| 7 | 16 | SE. | 1 | " | Conc.30 | 30 | 134 | -10 | 0 | " " | " | " | Dom., Stk. | H. | --- | |
| 7 | 16 | SE. | 2 | Spr. | --- -- | --- | 92 | 0 | 0 | Sand | " | " | Dom., Stk. | H. | --- | |
| 7 | 17 | SE. | 1 | Drl. | Iron 5 | 78 | 90 | -30 | 40 | Sand,gravel | Semiamu | " | Dom., Stk. | C.G.I.K. | 450 | Semiamu sediments. |
| 7 | 18 | SE. | 1 | Dug | Wood 48 | 10 | 116 | -4 | 7 | Sand | Quadra | " | Dom., Stk. | C.G.Q. | --- | |
| 7 | 20 | SW. | 1 | Drl. | Iron 4 | 88 | 160 | -30 | 40 | Sand,gravel | Colebrook | " | Dom. | C.G.I.N. | 250 | |
| 7 | 21 | NW. | 1 | Spr. | Wood 24 | 2 | 84 | 0 | 0 | Sand,gravel | Abbotsford | " | " | H. | --- | |
| 7 | 21 | NE. | 2 | Drn. | Iron 1½ | 19 | 150 | -15 | 0 | " " | " | " | " | H. | --- | |
| 7 | 22 | NE. | 1 | Drn. | Iron 1¼ | 24 | 164 | -15 | 0 | " " | " | " | Dom., Stk. | H.J. | --- | Log incomplete. |
| 7 | 22 | SE. | 2 | " | " 2 | 24 | 164 | -14 | 0 | " " | " | " | Dom., Irr. | H. | --- | |
| 7 | 22 | SE. | 3 | " | " 1¼ | 15 | 157 | -14 | 0 | " " | " | " | Dom., Irr. | H. | --- | |
| 7 | 22 | N[illegible] | 4 | " | " 2 | 12 | 153 | -10 | 0 | " " | " | " | Dom., Irr. | H. | --- | |
| 7 | 22 | NW. | 5 | Dug | Conc.36 | 10 | 154 | -9 | 0 | " " | " | " | Dom., Irr. | H. | --- | |
| 7 | 27 | SE. | 1 | " | --- 36 | 25 | 164 | -12 | 0 | " " | " | " | Dom., Stk. | H. | --- | |
| 7 | 28 | SW. | 1 | Spr. | Reservoir | 0 | 67 | 0 | 0 | --- | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 7 | 29 | NE. | 1 | Drl. | Iron 2 | 280 | 20 | +6 | 200 | Coarse sand | Quadra | " | Dom., Stk. | D.F.K.L.Q. | --- | " " |
| 7 | 29 | SE. | 2 | " | " 2 | 140 | 35 | +1 | --- | " " | pre-Vashon | " | Dom., Stk. | D.F.K.L.Q. | --- | " " |
| 7 | 29 | NW. | 3 | " | " 2 | 330 | 10 | +3 | 300 | Gravel | " " | " | Dom. | A.F.I.J. | 25 | |
| 7 | 30 | SW. | 1 | " | " 2 | 97 | 22 | +6 | 97 | Sand | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 7 | 32 | SE. | 1 | " | " 2 | --- | --- | +5 | --- | --- | --- | " | Dom., Stk. | D.F.I.J. | --- | " " |
| 7 | 33 | NE. | 1 | Spr. | --- 72 | 2 | 25 | 0 | --- | --- | --- | " | Dom., Stk. | D. | --- | |
| 7 | 3[illegible] | NE. | 2 | Dug | Wood 36 | 16 | 30 | -11 | 16 | Sand | pre-Vashon | " | Dom. | D.F.Q. | --- | |
| 7 | 34 | NE. | 1 | " | Conc.36 | 12 | 110 | -5 | 0 | Sand,gravel | Abbotsford | " | Dom., Stk. | H. | --- | |
| 7 | 34 | NE. | 2 | " | Wood 60 | 40 | 110 | -36 | 0 | " " | " | " | Dom., Stk. | H. | --- | |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 7 | 34 | NE. | 3 | Dug | Wood 30 | 30 | 140 | -31 | 0 | Sand, gravel | Abbotsford | Soft | Dom., Stk. | H. | --- | |
| 7 | 34 | SE. | 4 | Drn. | Iron 4 | 45 | 140 | -40 | 0 | " " | " | " | Dom., Stk. | H. | --- | Minor irrigation. |
| 7 | 34 | SE. | 5 | Dug | Conc.36 | 51 | 140 | -48 | 51 | Sand | pre-Vashon | " | Dom., Irr. | H.G.J. | --- | Peat in sand at El.89. |
| 7 | 34 | NW. | 6 | " | Wood 48 | 50 | 45 | -5 | --- | --- | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 3 | NE. | 1 | Drl. | Iron 1½ | 311 | 25 | +15 | 300 | Gravel | pre-Vashon | " | Dom., Stk. | F.N.J. | 100 | |
| 8 | 3 | SE. | 2 | " | " 4 | 150 | 40 | +1 | --- | --- | --- | " | Dom., Stk. | --- | 360 | Log incomplete. |
| 8 | 3 | SE. | 3 | Dug | Conc.36 | 9 | 60 | -2 | 0 | Sand | Sunnyside | " | Dom., Stk. | D. | --- | Shells at El.52 |
| 8 | 3 | SW. | 4 | Drl. | Iron 4 | 165 | 30 | +1 | 100 | Sand, gravel | pre-Vashon | " | Dom., Stk. | F.N.J. | 50 | |
| 8 | 4 | NE. | 1 | " | " 3 | 70 | 30 | +1 | --- | --- | --- | " | Dom., Stk. | --- | 200 | Log incomplete. |
| 8 | 4 | SE. | 2 | " | " 4 | 269 | 25 | +12 | --- | --- | --- | " | Dom., Stk. | --- | --- | " " |
| 8 | 4 | NW. | 3 | Drn. | " 3 | 14 | 38 | 0 | 16 | Gravel | Colebrook | " | Dom., Stk. | F.I.N. | --- | " " |
| 8 | 4 | NE. | 4 | Dug | Conc.36 | 19 | 65 | -17 | 17 | " | " | " | Dom., Stk. | F.N. | --- | |
| 8 | 5 | NE. | 1 | Drl. | Iron 4 | 122 | 30 | -10 | 121 | " | Semiamu | " | Dom., Stk. | F.I.K. | 500 | Sediments. |
| 8 | 5 | NW. | 2 | " | " 3 | 115 | 10 | +8 | 113 | Sand | " | " | Dom., Ind. | F.I.K. | 2000 | Surrey Co-op. |
| 8 | 6 | NE. | 1 | " | " 2 | 150 | 8 | +3 | --- | " | --- | " | Stk. | --- | --- | Log incomplete. |
| 8 | 6 | SW. | 2 | " | " 3 | 247 | 10 | +10 | 242 | " | --- | " | Dom., Stk. | --- | 200 | Natural flow. Log incomplete. |
| 8 | 6 | SW. | 3 | " | " 2 | 280 | 5 | +14 | 270 | " | --- | --- | Dom., Stk. | --- | 100 | Natural flow. Log incomplete. |
| 8 | 7 | SW. | 1 | " | " 2 | 81 | 10 | +2 | 65 | Gravel | Semiamu | Soft | Dom. | F.K. | --- | Semiamu sediments. |
| 8 | 7 | SW. | 2 | " | " 4 | 25 | 10 | +2 | 25 | " | " | " | Dom., Stk. | F.I.K. | 400+ | " " |
| 8 | 7 | SW. | 3 | Dug | Conc.48 | 11 | 8 | -2 | 5 | " | Colebrook | " | Dom., Stk. | F.N. | --- | |
| 8 | 7 | SW. | 4 | " | --- 48 | 22 | 79 | -5 | 22 | " | " | " | Dom. | G.I.N. | --- | |
| 8 | 7 | NW. | 5 | Drl. | Iron 3½ | 60 | 66 | -15 | 55 | " | " | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 7 | NE. | 6 | Dug | Wood 60 | 36 | 60 | -18 | 29 | " | " | " | Dom., Stk. | G.N. | --- | |
| 8 | 8 | SE. | 1 | " | Conc.72 | 23 | 135 | -21 | 17 | Sand | Quadra | " | Dom., Stk. | G.Q. | --- | |
| 8 | 8 | SE. | 2 | Spr. | Wood 24 | 5 | 49 | -2 | 0 | Gravel | --- | " | Dom. | --- | --- | |
| 8 | 8 | NW. | 3 | Drl. | Iron 2 | 75 | 70 | 0 | --- | --- | --- | " | " | --- | 10 | Natural flow. Log incomplete. |
| 8 | 8 | NW. | 4 | Spr. | Conc.72 | 2 | 78 | 0 | --- | Sand | --- | " | Dom., Stk. | --- | --- | |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 8 | 8 | SW. | 5 | Drl. | Iron 2 | 125 | 15 | 0 | 124 | Gravel | Semiamu | Soft | Dom., Stk. | F.I.K. | --- | Semiamu sediments. |
| 8 | 9 | SE. | 1 | Dug | Conc.48 | 17 | 110 | -15 | 12 | " | Colebrook | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 10 | NE. | 1 | Drl. | Iron 2 | 88 | 60 | 0 | 80 | Sand, gravel | Colebrook? | " | Dom., Stk. | F.I.N. | --- | |
| 8 | 10 | SE. | 2 | " | " 1½ | 197 | 45 | 0 | 194 | Coarse sand | pre-Vashon | " | Dom., Stk. | F.I.N.J. | 40 | Natural flow. |
| 8 | 10 | SE. | 3 | " | " 2 | 260 | 30 | +2 | 160 | Gravel | " " ? | " | Dom., Irr. | F.I.N.J. | 20 | " " |
| 8 | 10 | SW. | 4 | Drn. | " 2 | 61 | 70 | +1 | 60 | " | Colebrook | " | Dom., Stk. | F.I.N. | --- | |
| 8 | 10 | NW. | 5 | Dug | Conc.24 | 22 | 100 | -20 | 20 | Sand, gravel | " | " | Dom., Stk. | F.N. | --- | |
| 8 | 10 | NW. | 6 | Drl. | Iron 3 | 240 | 144 | -60 | --- | " " | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 10 | NW. | 7 | " | " 5 | 50 | 132 | -44 | 40 | " " | Colebrook | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 15 | NW. | 1 | Dug | Conc.36 | 45 | 140 | -30 | 45 | Gravel | " | " | Dom., Stk. | C.D.G.I.N. | --- | |
| 8 | 15 | SE. | 2 | " | " 48 | 27 | 150 | -23 | --- | " | Colebrook? | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 15 | SE. | 3 | Drl. | Iron 3 | 240 | 63 | 0 | 190 | " | pre-Vashon | " | Dom., Stk. | F.I.N.J. | --- | " " |
| 8 | 15 | SW. | 4 | Dug | Conc.48 | 21 | 120 | -19 | 21 | Sand | Quadra | " | Dom., Stk. | G.Q. | --- | " " |
| 8 | 17 | NE. | 1 | Drl. | Iron 5 | 131 | 171 | -91 | 30 | " | " | " | Dom., Stk. | G.Q. | --- | |
| 8 | 17 | SE. | 2 | Dug | Conc.60 | 24 | 218 | -21 | 24 | Gravel | Semiamu | " | Dom., Stk. | G.I.K. | --- | Semiamu sediments. |
| 8 | 17 | NW. | 3 | Drl. | Iron 3 | 150 | 12 | +4 | --- | --- | --- | " | Dom., Stk. | --- | 15 | Natural flow. Log incomplete. |
| 8 | 17 | NW. | 4 | Dug | Conc.36 | 3 | 50 | -2 | --- | Sand? | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 17 | NE. | 5 | Drl. | Iron 4 | 90 | 131 | -30 | 30 | Sand | Quadra | " | Dom., Stk. | G.Q. | --- | " " |
| 8 | 18 | NE. | 1 | Drl. | " 2 | 135 | 18 | +10 | --- | --- | --- | " | Dom., Stk. | --- | 350 | Natural flow. Log incomplete. |
| 8 | 18 | SE. | 2 | " | " 2 | 150 | 55 | +2 | --- | --- | --- | " | Dom., Stk. | --- | 20 | Natural flow. Log incomplete. |
| 8 | 18 | SW. | 3 | " | " 2 | 40 | 52 | -3 | --- | --- | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 18 | SW. | 4 | " | " 6 | 160 | 43 | +5 | --- | --- | --- | " | Dom., Stk. | --- | 600 | Natural flow. Log incomplete. |
| 8 | 18 | NE. | 5 | " | " 2 | 101 | 11 | +10 | --- | --- | --- | " | Dom., Stk. | --- | 450 | Natural flow. Log incomplete. |
| 8 | 20 | SE. | 1 | Dug | --- 36 | 20 | 110 | -20 | 6 | Sand | Quadra | " | Dom., Stk. | G.Q. | --- | |
| 8 | 20 | SW. | 2 | Drl. | Iron 2 | 150 | 20 | 0 | --- | --- | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 20 | NW. | 3 | " | " 3 | 325 | 12 | +20 | 325 | Sand | --- | " | Dom., Stk. | --- | 1000 | " " |
| 8 | 21 | NE. | 1 | Dug | --- 48 | 18 | 190 | -15 | 18 | " | Quadra | " | Dom., Stk. | G.Q. | --- | |

| Location | | | Well No. | Description of Well | | | | | Principal Aquifers | | | Water | | Formations Penetrated | Yield | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 8 | 21 | NW. | 2 | Dug | --- 48 | 30 | 145 | -26 | 15 | Sand | Quadra | Soft | Dom., Stk | G.Q. | --- | |
| 8 | 21 | NE. | 3 | Spr. | --- 48 | 1 | 90 | 0 | 0 | Sand, gravel | Colebrook | " | Dom., Stk. | G.N. | --- | |
| 8 | 21 | NE. | 4 | Dug | Conc. 72 | 16 | 110 | -12 | 11 | " " | " | " | Dom., Stk. | G.N. | --- | |
| 8 | 27 | NE. | 1 | Drl. | Iron 2 | 120 | 75 | 0 | 100 | Sand | --- | " | Dom., Stk. | --- | 75 | Natural flow. Minor irrigation. |
| 8 | 27 | SW. | 2 | Dug | --- 48 | 23 | 148 | -20 | 18 | Gravel | Colebrook | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 27 | SW. | 3 | " | --- 48 | 40 | 182 | -35 | 40 | " | " | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 27 | SW. | 4 | " | Conc. 36 | 8 | 69 | -7 | 0 | Sand | Sunnyside | " | Dom. | D. | --- | |
| 8 | 27 | NW. | 5 | " | " 48 | 9 | 50 | -7 | 0 | " | " | " | Dom., Stk. | D. | --- | |
| 8 | 28 | SE. | 1 | Drl. | Iron 3 | 80 | 90 | +1 | --- | --- | --- | " | Dom. | --- | 60 | Natural flow. Log incomplete. |
| 8 | 28 | SE. | 2 | " | " 3 | 90 | 35 | +4 | --- | --- | --- | " | --- | --- | 10 | Natural flow. Abandoned. |
| 8 | 28 | SW. | 3 | " | " 2 | 345 | 30 | +6 | --- | --- | --- | " | Dom., Stk. | --- | 15 | Natural flow. Log incomplete. |
| 8 | 28 | NE. | 4 | " | " 2 | 390 | 20 | +3 | --- | Gravel | --- | " | Dom. | --- | 60 | Natural flow. Log incomplete. |
| 8 | 28 | NW. | 5 | Dug | Conc. 24 | 10 | 22 | -3 | 8 | Sand | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 28 | NW. | 6 | " | " 36 | 9 | 28 | -1 | 9 | Gravel | --- | " | Dom., Stk. | --- | --- | " " |
| 8 | 28 | NE. | 7 | Drn. | Iron 3 | 12 | 40 | -9 | 0 | Sand | Sunnyside | " | Dom., Stk. | D. | --- | |
| 8 | 29 | SE. | 1 | Drl. | " 2½ | 390 | 17 | +6 | --- | --- | --- | " | Dom., Stk. | --- | 100 | Natural flow. Log incomplete. |
| 8 | 29 | SW. | 2 | " | " 3 | --- | 20 | +25 | --- | --- | --- | " | Dom., Stk. | --- | 2400 | Natural flow. Log incomplete. |
| 8 | 29 | SW. | 3 | " | " 4 | 260 | 12 | +23 | --- | --- | --- | " | Dom., Stk. | --- | 500 | Natural flow. Log incomplete. |
| 8 | 29 | NW. | 4 | " | " 2 | 270 | 10 | +20 | --- | Gravel | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 8 | 29 | SE. | 5 | " | " 2 | 327 | 20 | +10 | 327 | " | Colebrook? | " | Dom., Stk. | A.F.I.N. | 100 | Natural flow. |
| 8 | 30 | SW. | 1 | " | " 6 | 23 | 45 | 0 | 25 | " | " | " | Dom., Stk. | F.N. | --- | |
| 8 | 30 | SW. | 2 | Dug | --- 48 | 31 | 75 | -20 | 25 | Sand, gravel | " | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 30 | SW. | 3 | " | --- 48 | 12 | 140 | -3 | 12 | " " | " | " | Dom., Stk. | G.I.N. | --- | |
| 8 | 30 | NE. | 4 | Drl. | Iron 3 | 90 | 20 | +9 | --- | --- | --- | " | Dom., Stk. | --- | 60 | Natural flow. Log incomplete. |
| 8 | 31 | SE. | 1 | " | " 2½ | 180 | 25 | +6 | --- | Sand | --- | " | Dom., Stk. | --- | 120 | Natural flow. Log incomplete. |
| 8 | 31 | SW. | 2 | " | " 2 | 65 | 30 | +3 | 60 | Gravel | Colebrook? | " | Dom., Stk. | F.N. | 100 | Natural flow. |
| 8 | 31 | SW. | 3 | " | " 2 | 102 | 29 | +5 | 90 | Sand | --- | " | Dom., Stk. | F.N.J. | 300 | Natural flow. Log incomplete. |
| 8 | 31 | SW. | 4 | " | " 2½ | 240 | 26 | +8 | 240 | Gravel | pre-Vashon | " | Dom., Stk. | F.N.J. | 1500 | Natural flow. Log incomplete. |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 8 | 31 | NW. | 5 | Dug | --- 48 | 25 | 105 | -21 | 5 | Gravel | Colebrook | Soft | Dom., Stk. | G.I.N. | --- | Static level constant. |
| 8 | 31 | NE. | 6 | " | Conc.36 | 31 | 166 | -20 | 31 | " | " | " | Dom., Irr. | G.I.N. | --- | |
| 8 | 32 | SE. | 1 | " | --- 60 | 30 | 104 | -26 | 30 | Sand,gravel | " | " | Dom. | G.I.N. | --- | |
| 8 | 32 | SE. | 2 | Drl. | Iron 3 | 212 | 10 | +23 | 212 | Sand | Quadra | " | Dom., Stk. | A.F.G.I.K.L.Q. | 1400 | Natural flow. Shells at El.-202'. |
| 8 | 32 | SW. | 3 | " | " 2 | 85 | 112 | -70 | 70 | Gravel | Colebrook | " | Dom., Stk. | C.G.I.N. | 300 | |
| 8 | 33 | SE. | 1 | Dug | --- 36 | 14 | 66 | -11 | 0 | Sand | Sunnyside | " | Dom. | D. | --- | |
| 8 | 33 | SE. | 2 | " | Wood 48 | 12 | 65 | -9 | 0 | " | " | " | " | D. | --- | |
| 8 | 33 | SE. | 3 | " | Conc.120 | 15 | 42 | -12 | 0 | " | " | " | " | D. | --- | |
| 8 | 33 | SW. | 4 | " | " 36 | 14 | 35 | -10 | 0 | " | " | " | " | D. | --- | |
| 8 | 33 | SW. | 5 | Drn. | Iron 2 | 16 | 40 | -14 | 0 | " | " | " | " | D. | --- | |
| 8 | 34 | NE. | 1 | Dug | Conc.36 | 14 | 40 | -10 | 8 | Gravel | Colebrook | " | Dom., Stk. | D.G.N. | --- | |
| 8 | 34 | SE. | 2 | " | " 36 | 9 | 79 | -7 | 0 | Sand | Sunnyside | " | Dom., Stk. | D. | --- | |
| 8 | 34 | NW. | 3 | " | " 48 | 9 | 65 | -4 | 0 | " | " | " | Dom., Stk. | D. | --- | |
| 8 | 34 | NW. | 4 | " | Wood 36 | 12 | 52 | -5 | 0 | " | " | " | Dom. | D. | --- | |
| 9 | 3 | NE. | 1 | " | Conc.36 | 7 | 13 | -5 | 0 | Gravel | Alouette | " | Dom., Stk. | E. | 10,000 | Estimated yield. |
| 9 | 3 | SE. | 2 | " | " 30 | 10 | 48 | -6 | 5 | " | Colebrook | " | Dom. | F.N. | --- | |
| 9 | 3 | SW. | 3 | " | " 36 | 12 | 47 | -6 | 0 | " | Alouette | " | " | E. | --- | |
| 9 | 3 | SW. | 4 | " | " 36 | 10 | 41 | -7 | 0 | " | " | " | Dom., Stk. | E. | --- | |
| 9 | 3 | SW. | 5 | " | Wood 48 | 8 | 25 | -6 | 0 | " | " | " | Dom., Ind. | E. | --- | Surrey Cedar Co. |
| 9 | 4 | SE. | 1 | " | " 42 | 12 | 52 | -11 | 0 | Sand | Sunnyside | " | Dom., Stk. | D. | --- | |
| 9 | 4 | SW. | 2 | " | " 48 | 11 | 50 | -8 | 0 | Sand,gravel | " | " | Dom., Stk. | D.E.F. | --- | Gravel aquifer probably Alouette. |
| 9 | 4 | SE. | 3 | " | " 120 | 14 | 15 | -13 | 0 | " " | " | " | Dom., Ind. | E.F. | --- | Pt. Kells Sawmill. |
| 9 | 5 | SE. | 1 | " | " 48 | 11 | 100 | -7 | 0 | Gravel | " | " | Dom. | E. | --- | |
| 9 | 5 | SE. | 2 | Spr. | " 48 | 2 | 105 | 0 | 0 | Sand | Quadra | " | " | Q. | 200 | |
| 9 | 5 | SW. | 3 | Dug | Conc.36 | 35 | 181 | -31 | --- | " | " | " | " | G.I.Q. | --- | |
| 9 | 5 | NW. | 4 | " | " 36 | 10 | 165 | -9 | 5 | " | " | " | " | G.I.Q. | --- | |
| 9 | 5 | NW. | 5 | " | Wood 36 | 8 | 135 | -5 | --- | --- | --- | " | " | --- | --- | Log incomplete. |
| 9 | 5 | NW. | 6 | " | " 36 | 5 | 100 | -4 | 5 | Sand | Quadra | " | " | C.Q. | --- | Shells in Quadra sediments. |
| 9 | 5 | NE. | 7 | Spr. | " 48 | 4 | 115 | 0 | 0 | " | " | " | " | Q. | --- | |
| 9 | 6 | SE. | 1 | Dug | " 48 | 36 | 197 | -33 | 7 | " | " | " | Dom., Stk. | G.I.Q. | --- | |
| 9 | 6 | SE. | 2 | " | Conc.36 | 57 | 210 | -50 | 15 | " | " | " | Dom., Stk. | G.I.Q. | --- | |
| 9 | 6 | SW. | 3 | " | " 48 | 7 | 50 | -4 | 7 | Gravel | Colebrook | " | Dom., Stk. | G.I.N. | --- | |

| LOCATION | | | WELL NO. | DESCRIPTION OF WELL | | | | | PRINCIPAL AQUIFERS | | | WATER | | FORMATIONS PENETRATED | YIELD | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tp. | Sec. | ¼ | | Type | Casing, diam. (inches) | Depth (ft.) | Collar Elev., (ft.) | Static Level (ft.) | Depth to top (ft.) | Character of material | Formation | Quality | Use | | (gals /hr) | |
| 9 | 6 | SW. | 4 | Dug | Conc. 48 | 14 | 90 | -10 | 14 | Gravel | Colebrook | Soft | Dom., Stk. | G.I.N. | --- | |
| 9 | 6 | NW. | 5 | Drl. | Iron 5 | 60 | 209 | -46 | 49 | " | " | " | Dom. | G.I.N. | --- | |
| 9 | 6 | NW. | 6 | Dug | Conc. 60 | 20 | 189 | -11 | --- | --- | --- | --- | " | --- | --- | Log incomplete. |
| 9 | 6 | NW. | 7 | Drl. | Iron 4 | 60 | 135 | -52 | 12 | Gravel | Colebrook | Soft | " | G.I.N. | --- | |
| Blk. | Rge. | Lot | | | | | | | | | | | | | | |
| 5N | 1W | 7 | 1 | Drl. | Iron 4 | 130 | 245 | -126 | 126 | [illegible] | pre-Vashon | Soft | Dom. | C.G.I.J. | 500 | |
| 5N | 1W | 7 | 2 | Dug | Wood 72 | 12 | 82 | -9 | 4 | [illegible] | Quadra | " | Dom., Stk. | C.Q. | --- | |
| 5N | 1W | 10 | 1 | Spr. | --- -- | 0 | 147 | 0 | 0 | Gravel | --- | " | Dom., Stk. | --- | --- | |
| 5N | 1W | 14 | 4 | Dug | --- 60 | 17 | 198 | -16 | 11 | " | Colebrook | " | Dom. | G.N. | --- | |
| 5N | 1W | 16 | 2 | " | --- 54 | 34 | 288 | -12 | --- | --- | --- | " | Dom., Stk. | --- | --- | Log incomplete. |
| 5N | 1W | 20 | 1 | " | --- 48 | 20 | 293 | -12 | 12 | Sand, gravel | Colebrook | " | Dom., Stk. | G.I.N. | --- | |
| 5N | 1W | 20 | 2 | " | --- 48 | 25 | 282 | -21 | --- | " " | " | " | Dom., Stk. | --- | --- | Log incomplete. |
| 5N | 1W | 20 | 3 | Spr. | --- -- | 0 | 255 | 0 | 0 | " " | " | " | Dom., Stk. | N. | --- | Also used for irrigation. |
| 5N | 1W | 22 | 1 | Dug | --- 36 | 12 | 220 | -8 | 12 | " " | " | " | Dom., Stk. | G.N. | --- | |
| 5N | 1W | 22 | 3 | " | --- 72 | 65 | 268 | -35 | --- | --- | --- | " | Dom. | --- | --- | Log incomplete. |
| 5N | 1W | 24 | 1 | " | Wood 60 | 32 | 138 | -29 | --- | --- | --- | " | " | --- | --- | " " |
| 5N | 1W | 24 | 2 | " | " 48 | 23 | 198 | -20 | 9 | Sand | Quadra | " | " | G.Q. | --- | |
| 5N | 1W | 24 | 3 | " | --- 60 | 32 | 195 | -28 | 12 | " | " | " | " | G.Q. | --- | |
| 5N | 1W | 25 | 1 | " | Wood 36 | 23 | 195 | -18 | 2 | " | Quadra? | " | Dom., Stk. | G.N.Q. | --- | |
| 5N | 1W | 26 | 5 | " | --- 48 | 12 | 184 | -9 | 9 | " | Colebrook | " | Dom., Stk. | G.I.N. | --- | Log incomplete. |
| 5N | 1W | 27 | 6 | " | --- 60 | 16 | 255 | -11 | 16 | Sand, gravel | " | " | Dom. | G.I.N. | --- | |
| 5N | 1W | 28 | 4 | " | --- 60 | 20 | 290 | -10 | 20 | " " | " | " | Dom., Stk. | G.I.N. | --- | |
| 5N | 1W | 28 | 5 | " | --- 48 | 17 | 255 | -14 | 17 | " " | " | " | Dom. | G.I.N. | --- | |
| 5N | 1W | 32 | 1 | " | --- 48 | 24 | 322 | -16 | --- | " " | " | " | Dom., Stk. | G.I.N. | --- | Log incomplete. |
| 5N | 1W | 33 | 2 | " | --- 48 | 9 | 300 | -5 | 8 | " " | " | " | Dom., Stk. | G.I.N. | --- | |
| 5N | 1W | 33 | 3 | " | --- 48 | 25 | 292 | -17 | 25 | " " | " | " | Dom., Stk. | G.I.N. | --- | |
| 5N | 1W | 34 | 1 | Drl. | Iron 5 | 38 | 230 | -30 | 38 | Sand | Quadra | " | Pub. | G.I.N.Q. | --- | North Surrey High School. |
| 5N | 1W | 35 | 1 | Spr. | --- 48 | 4 | 91 | 0 | 0 | " | --- | " | Dom. | --- | --- | |
| 5N | 1W | 35 | 2 | Dug | --- 36 | 18 | 173 | -14 | --- | --- | --- | " | " | --- | --- | Log incomplete. |
| 5N | 1W | 36 | 1 | " | Wood 48 | 17 | 100 | -12 | --- | --- | --- | " | " | --- | --- | " " |
| 5N | 2W | 36 | 1 | " | Conc. 72 | 60 | 270 | -59 | 34 | Sand, gravel | Semiamu | " | " | G.I.K.L. | 2000 | Channel gravel. |

CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 322

# GROUND-WATER RESOURCES OF SURREY MUNICIPALITY BRITISH COLUMBIA

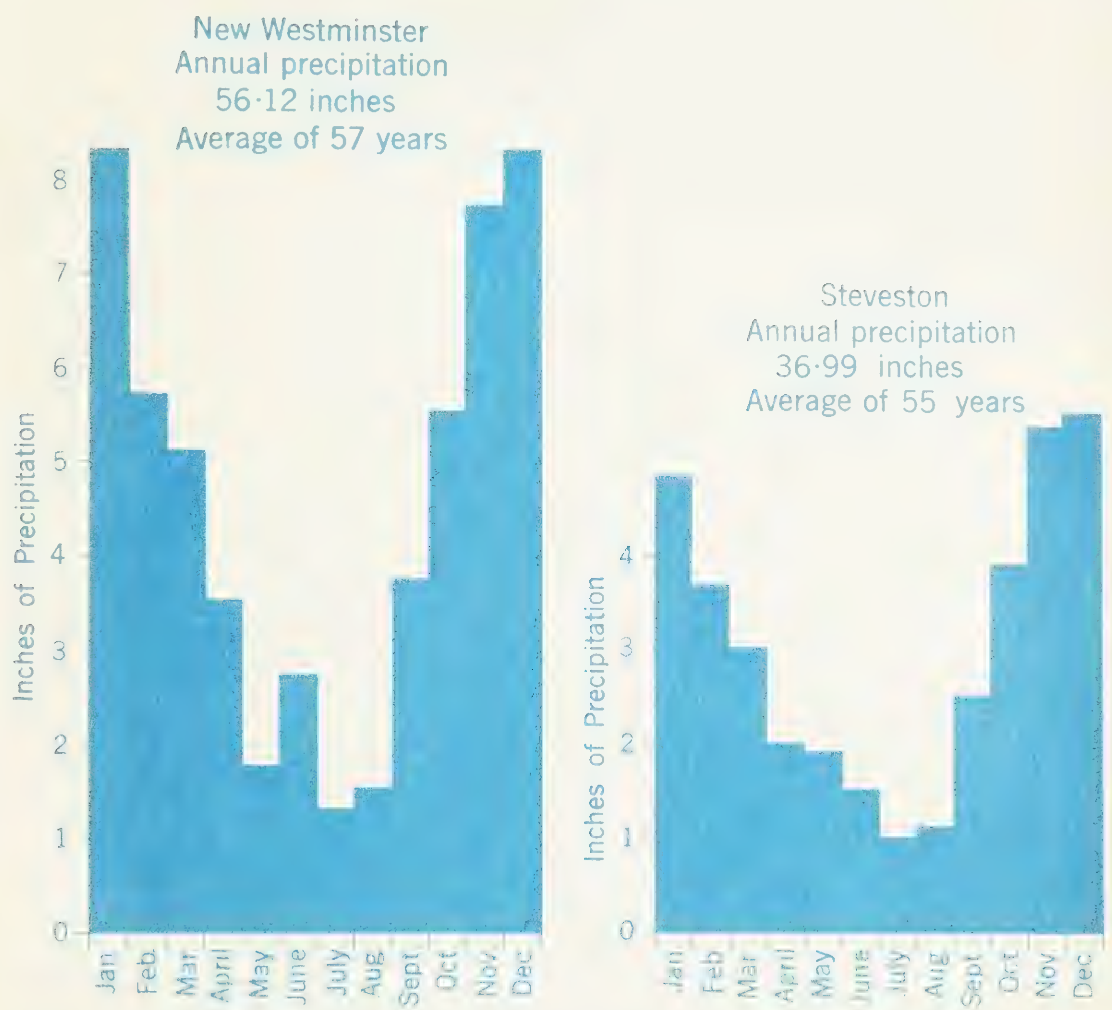
By

J. E. Armstrong and W. L. Brown

MAPS AND FIGURES



OTTAWA
1953




AVERAGE MONTHLY PRECIPITATION FOR NEW WESTMINSTER AND STEVESTON
(From Dominion Meteorological Service)

Note. The northern part of Surrey Municipality will conform to New Westminster, the southern part to Steveston

G. S. C.

*To accompany Water Supply Paper No. 322*

# TABLE OF PLEISTOCENE AND RECENT DEPOSITS

## ENVIRONMENTAL DIVISIONS AND DESCRIPTIONS

| GROUP | GLACIAL DEPOSITS | | | | MARINE DEPOSITS | MARINE AND NON-MARINE DEPOSITS | | NON-MARINE DEPOSITS | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | TILL | GLACIO-FLUVIAL | GLACIO-LACUSTRINE | GLACIO-MARINE | OFF SHORE | SHORE | ESTUARINE AND DELTAIC | CHANNEL AND FLOODPLAIN | SWAMP | SLOPE |
| **SALISH** *(Post glacial deposits still being formed)* | | | | | | *Gravel, sand, silt, and clay, present day shorelines (25)* | *RICHMOND DELTA, clay, silty clay, silt, and sand being deposited at mouth of Fraser River (200?)* | *Sand, silt and silty clay deposited in floodplains, deltas, and channels of rivers and streams; includes FRASER FLOODPLAIN DEPOSITS; (50)* | *Peat and muck (20)* | *Talus and slopewash mantle (10)* |
| **CAPILANO** *(Post glacial deposits no longer being formed)* | | | | | *CLOVERDALE SEDIMENTS; clay, silty clay, and sand; stony clay and poorly sorted till-like mixtures, minor gravel; submarine slopewash (250)* | *BOSE GRAVEL; gravel and minor sand as spits, bars, beaches, etc. and as wave-washed lag gravel veneers (10)* | *ALOUETTE GRAVEL; alluvial sand and gravel terrace deposits adjacent to Fraser River (20)* | | | |
| **VASHON** *(Deposits of last glaciation of ice-sheet proportion)* | | *ABBOTSFORD OUTWASH; gravel, sand silt; minor till and stony clay, formed as ice-contact deposits and as fluviatile deposits of meltwater streams (125)* | | *NEWTON STONY CLAY (marine drift); stony, stony silty and gritty clay; stony silt; minor clay, silty clay, and sand. Takes the place of till in places (150)* | | *SUNNYSIDE SAND, well sorted sand as beach and tidal deposits near a source of sand (15)* | | | | |
| | *SURREY TILL; sandy to clayey till and substratified drift* | | | | | | | | | |
| EROSION INTERVAL, CONSIDERABLE RELIEF DEVELOPED ON UNDERLYING DEPOSITS | | | | | | | | | | |
| **SEMIAMU** *(Deposits related to glaciation, missing in much of area)* | | *SEMIAMU SEDIMENTS* Gravel and sand (25) | *Clay, silt, varve-like clay and silt (150)* | | | | | | | |
| | *SEMIAMU TILL, sandy to clayey till and substratified drift (60)* | | | | | | | | | |
| EROSION INTERVAL, CONSIDERABLE RELIEF DEVELOPED ON UNDERLYING DEPOSITS | | | | | | | | | | |
| **QUADRA** *(Intertill sediments)* | | | | | *SAPPERTON SEDIMENTS; sand, silt, gravel, silty clay, clay, and poorly sorted till-like mixtures including stony clay; may be Cloverdale (40)* | | | *COLEBROOK GRAVEL; gravel and sand; deltaic and channel deposits (85)* | | |
| | | | | | | | | *NICOMEKL SILT; probably interglacial Fraser River silt, sand, and minor gravel (110)* | | |
| | | | | | | | | *POINT GREY BEDS; sand, silt, and peat (60)* | | |
| **SEYMOUR** *(Deposits related to glaciation)* | | *LYNN OUTWASH; Gravel and sand, may grade upward into normal river deposits (25)* | *SISTERS VARVED CLAY. varve-like clay, silt, and sand (500+)* | | | | | | | |
| | *SEYMOUR TILL; silty to clayey till and substratified drift (60)* | | | | | | | | | |
| CLAY, SILT, SAND, GRAVEL, AND TILL PROBABLY OF GLACIAL, INTERGLACIAL, AND PREGLACIAL ORIGIN; EXPOSED ONLY IN DRILL-HOLES | | | | | | | | | | |

*Note Numbers in parentheses are maximum thicknesses in feet*

*To accompany Water Supply Paper No. 322*

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
GEOLOGICAL SURVEY OF CANADA


To accompany Water Supply Paper No

LOCATION AND TYPES OF WELLS AND GROUND-WATER CONDITIONS

# SURREY MUNICIPALITY

NEW WESTMINSTER DISTRICT
BRITISH COLUMBIA

Scale 1 Inch to ½ Mile

CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA


To accompany Water Supply Paper No. 322

PUBLISHED 1954

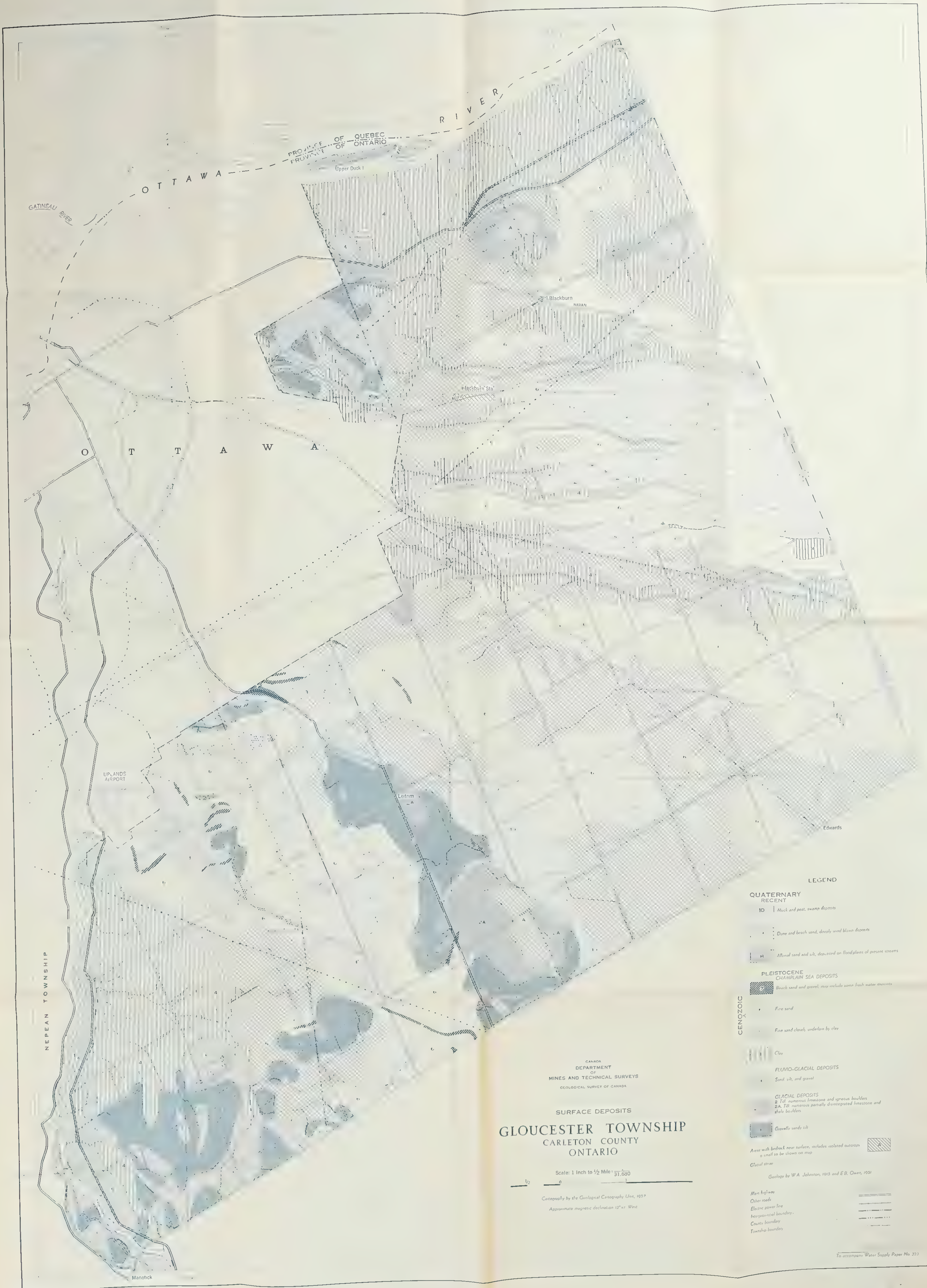
SURFACE DEPOSITS

# SURREY MUNICIPALITY

NEW WESTMINSTER DISTRICT

BRITISH COLUMBIA

Scale 1 Inch to ½ Mile



OTTAWA RIVER
PROVINCE OF QUEBEC
PROVINCE OF ONTARIO
Upper Duck I.
GATINEAU RIVER
Blackburn
NAVAN
Blackburn Sta.
O T T A W A
UPLANDS AIRPORT
Leitrim
Edwards
NEPEAN TOWNSHIP
Manotick
PUBLISHED, 1957
CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
GEOLOGICAL SURVEY OF CANADA
SURFACE DEPOSITS
GLOUCESTER TOWNSHIP
CARLETON COUNTY
ONTARIO
Scale: 1 Inch to 1/2 Mile = 1/31,680
1/2
0
1
Cartography by the Geological Cartography Unit, 1957
Approximate magnetic declination 13° 47' West
LEGEND
CENOZOIC
QUATERNARY
RECENT
10 Muck and peat, swamp deposits
Dune and beach sand, deeply wind blown deposits
Alluvial sand and silt, deposited on flood plains of present streams
PLEISTOCENE
CHAMPLAIN SEA DEPOSITS
7 Beach sand and gravel; may include some fresh water deposits
Fine sand
Fine sand closely underlain by clay
Clay
FLUVIO-GLACIAL DEPOSITS
Sand, silt, and gravel
GLACIAL DEPOSITS
2 Till: numerous limestone and igneous boulders
2A. Till: numerous partially disintegrated limestone and shale boulders
Gravelly sandy till
Areas with bedrock near surface, includes isolated outcrops too small to be shown on map
A
Glacial striae
Geology by W.A. Johnston, 1915 and E.B. Owen, 1951
Main highway
Other roads
Electric power line
Interprovincial boundary
County boundary
Township boundary
To accompany Water Supply Paper No. 323

CENOZOIC

6 Fine sand

5 Fine sand closely underlain by clay

4 Clay

FLUVIO-GLACIAL DEPOSITS

3 Sand, silt, and gravel

GLACIAL DEPOSITS

2. Till: numerous limestone and igneous boulders

2A. Till: numerous partially disintegrated limestone and shale boulders

1 Gravelly sandy till

Areas with bedrock near surface; includes isolated outcrops too small to be shown on map . . . . . . . . . . . . . . . . A

Glacial striae

Geology by W.A. Johnston, 1915 and E.B. Owen, 1951

Main highway . . . . . . . . . . . . . . . . . . . . . . . . . . . . (17)

Other roads . . . . . . . . . . . . . . . . . . . . . . . . . . . .

Electric power line . . . . . . . . . . . . . . . . . . . . . . . .

Interprovincial boundary . . . . . . . . . . . . . . . . . . . .

County boundary . . . . . . . . . . . . . . . . . . . . . . . .

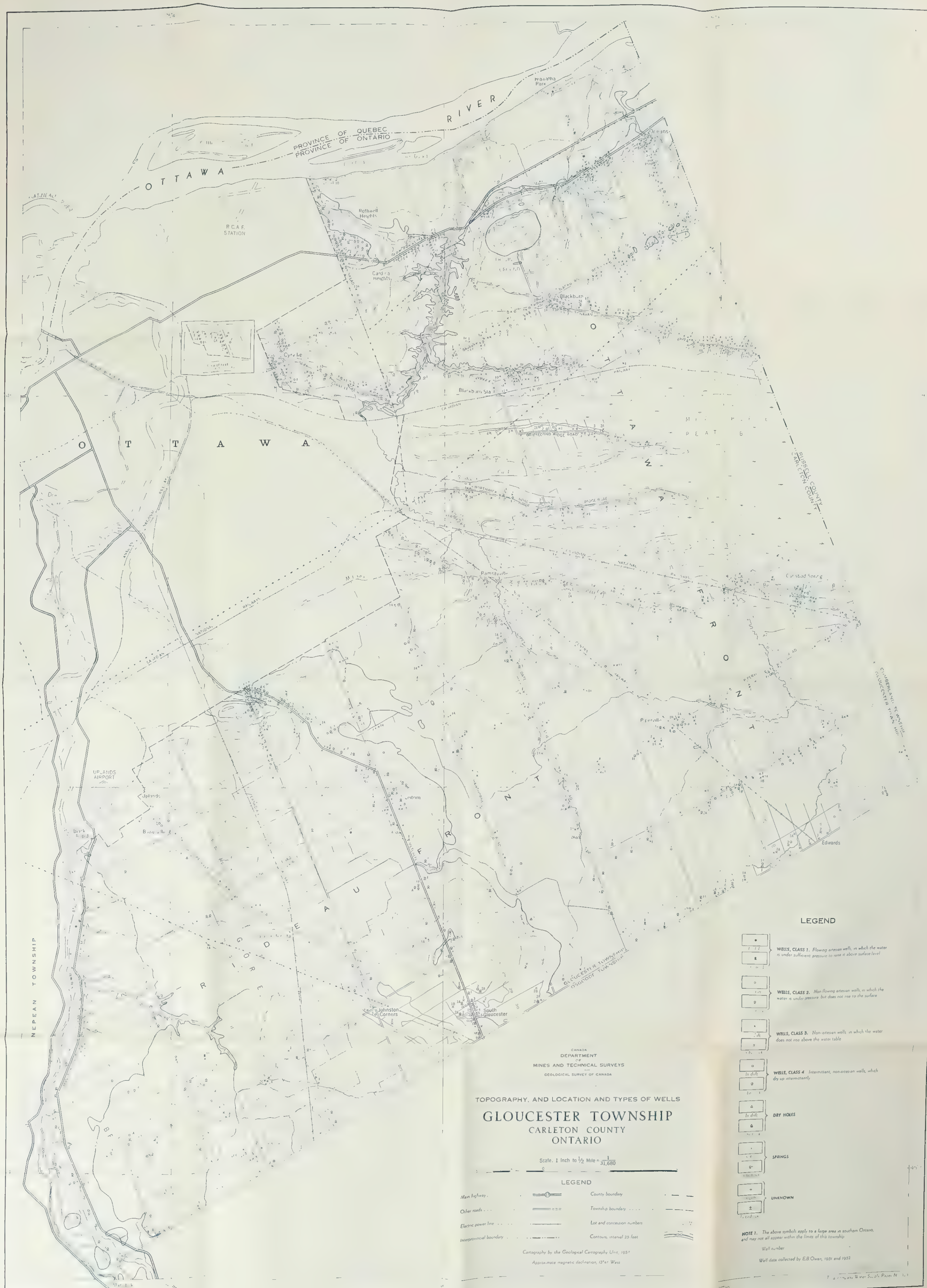
Township boundary . . . . . . . . . . . . . . . . . . . . . . .

45° 15′

CANADA, GEOLOGICAL SURVEY

To accompany Water Supply Paper No. 323

0′


OTTAWA RIVER
PROVINCE OF QUEBEC
PROVINCE OF ONTARIO
Hiawatha Park
Rothwell Heights
R.C.A.F. STATION
Cardinal Heights
Blackburn
Cyrville
Blackburn Sta.
O T T A W A
OTTAWA FRONT
MILE PLAT
RUSSELL COUNTY
CARLETON COUNTY
Carlsbad Springs
CUMBERLAND TOWNSHIP
GLOUCESTER TOWNSHIP
RIDEAU FRONT
UPLANDS AIRPORT
Uplands
Leitrim
Edwards
RIDEAU GORE
GLOUCESTER TOWNSHIP
OSGOODE TOWNSHIP
Johnston Corners
South Gloucester
NEPEAN TOWNSHIP
CANADA
DEPARTMENT
OF
MINES AND TECHNICAL SURVEYS
GEOLOGICAL SURVEY OF CANADA
TOPOGRAPHY, AND LOCATION AND TYPES OF WELLS
GLOUCESTER TOWNSHIP
CARLETON COUNTY
ONTARIO
Scale. 1 Inch to 1/2 Mile = 1/31,680
LEGEND
Main highway
Other roads
Electric power line
Interprovincial boundary
County boundary
Township boundary
Lot and concession numbers
Contours, interval 25 feet
Cartography by the Geological Cartography Unit, 1957
Approximate magnetic declination, 13°47' West
LEGEND
WELLS, CLASS 1. Flowing artesian wells, in which the water is under sufficient pressure to raise it above surface level
WELLS, CLASS 2. Non flowing artesian wells, in which the water is under pressure but does not rise to the surface
WELLS, CLASS 3. Non-artesian wells, in which the water does not rise above the water table
In drift
WELLS, CLASS 4 Intermittent, non-artesian wells, which dry up intermittently
In drift
DRY HOLES
SPRINGS
UNKNOWN
NOTE 1. The above symbols apply to a large area in southern Ontario, and may not all appear within the limits of this township
Well number
Well data collected by E.B. Owen, 1951 and 1952
75°30'

In bedrock

In drift

In bedrock

**WELLS, CLASS 4.** *Intermittent, non-artesian wells, which dry up intermittently*

In drift

In bedrock

**DRY HOLES**

In drift

In bedrock

**SPRINGS**

45° 15′

In drift

In bedrock

**UNKNOWN**

**NOTE 1.** *The above symbols apply to a large area in southern Ontario, and may not all appear within the limits of this township*

*Well number* . . . . . . . . . . . . . . . . . . . 2

*Well data collected by E.B.Owen, 1951 and 1952*

75° 30′

*To accompany Water Supply Paper No. 323*


PUBLISHED 1957

CHAZY

5 — *ST. MARTIN FORMATION: shale, sandstone, impure limestone, dolomite*

4 — *ROCKCLIFFE FORMATION: shale with lenses of sandstone*

BEEKMANTOWN

3 — *OXFORD FORMATION: dolomite and limestone*

2 — *MARCH FORMATION: interbedded sandstone and sandy dolomite*

ORDOVICIAN OR CAMBRIAN

1 — *NEPEAN FORMATION: sandstone*

*Outcrop, area of outcrop* . . . . . . . . . . . . ×, (× ×)

*Bedding (inclined)* . . . . . . . . . . . .

*Fault (defined, approximate)* . . . . . . . . . . . .

45° 15′

*Geology by A. E. Wilson, 1935*

*Main highway* . . . . . . . . . . . . (17)

*Other roads* . . . . . . . . . . . .

*Electric power line* . . . . . . . . . . . .

*Interprovincial boundary* . . . . . . . . . . . .

*County boundary* . . . . . . . . . . . .

*Township boundary* . . . . . . . . . . . .

CANADA GEOLOGICAL SURVEY

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